Popular Science

RADIO SECTION PAGE 76

Confessions of a radio "Gup" -- How to build a two-tube reflex set.

A "Radio Doctor" tells you how to get the most from your outfit.



DECEMBER

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In This Issue

LIL		1110	13346
			Page
Popular The Res	Scient Mar	ce Institu	te of Standards 33
By Lie	w. L.	m. Frinks	e Z.K.J. gh Green, U.S. N. and" 38
$B_{\mathcal{H}}G_{i}$	B. Se.	yneed	
Ho tita	inspp	Gagliord	talians 40
What I	CTCM.	Rutus Fr	Toys and Men 42
A Yast I	Spell of	resing th	e Sun
How Ty	pewri	Holling Bets	aye Criminale, 45 ork River, 47
They On	see La	ved in Yo	mr Backy atd., 48
By Ge	or pe	Appel	- 13e" 50
How to	arles	Mallory 1	Variant, M.D.
Payer E	object.	h for Ev	cryboly S
A New l	Electr	ical Pilot	for Ships 56
Old Rose	No.	or Peacet	r House 57
Trapper	Driv	es l'esm	of Wolves 58
OHOP-AFII	1 2st ex	epierack.	CARLES CARRES OF
A VCH I	ALC: U	THE DAY OF THE	The state of the s
Scientific	ليناب	sting Dis	plays 92
Soliton	The D	ation's C	andy 60
Ast Bab	Diss. 2	orm me	akwater 61
ar mismi	h-1 a 3 f	a typineks	63
Commin	and the	air for 3	Leu 62
Threating	100	alle has MI	otor
Federing	Barley.	Corrence	63
Bridge C	able	Har 185.	66 Strands 64
Growth	Tre	er Becor	ded 64
Organ W	indox	vs Locke	65
Back to	Harris	Warmer.	55
Chale	THE PER	Tarrett	dring 66
Burto Tu	French	men a Sle	gb 66
15 Secrettra	ETONE.	and I ar	Combined 67
- Induction	- Mat	ches for	Combined 97
Load Say	an of	in Bustilles	10 Al
Count S	11 13	and in No	vy , 68 es 60 e-Climber 69
Bridge	lune	from Tre	60
World a	Char	noion Tre	e-Climber 69
Propelle	r Add	s Thrills	to Skiing 69
Con Contral S	Benefit	CARLES SELLET	7.5
Flying "	Wind	ove Shutt	ex 75
Fightina	the	Roll Wee	er 76
25 25 0 0 0	CHARGO THE	Lamous	Bearing 71
Seaman	e Carl	ries Li Pa	ment the T
The Chil	v Ter	dese Plan	P
Moving	History	orte Palm	Tree 72
Odd Put	rified	Would E	HOCK
Maria	Laus	el Carrie	Taxanana 13
World	Lagu	est Clam	
Crant W	Angle	as Rind	Washes Streets 74
Markins	C Source	cus and	Washes Streets 74
THERET	Carc	LOT Auto	Hood
		and Car.	
Valve 2	C3D /3	treet into	Kiver 75
Corners I	for A	one Flore	letery 73
Radio -	the ?	Yew Paul	Revere 76
The "By	action f	dehthous	77
Confess	mas a	d o Hudio	OSD 78
How I I	Max. 3	Region Do	tor 79
A-B-C's	of B	deeper adio Lan E. Marti	guage #0
Who La	n But	ld the Sm	allest Set? Ki
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HAT germs exist is certain knowledge, but that they are the cause of disease is quite a different statement.

If the theory that germs are the primary cause of disease is correct, it follows that the introduction of germs into the living organism would produce disease in every case.

The instances that prove this untrue are so legion that the germ theorists have been compelled to explain that the germs are impotent UNLESS THE POWER OF RESISTANCE OF THE PATIENT IS SUBNORMAL.

Power of resistance may be measured in terms of life current or vitality. The stronger the life current, the greater the resistance and, vice versa, the weaker the life current, the weaker the resistance. So we may conclude that where 100 per cent of life current, or vitality, exists the susceptibility is zero; and where 50 per cent exists the resistance is small and the susceptibility correspondingly great.

It requires but little reasoning from these facts to conclude that those who centract typhold, for instance, owe their susceptibility to a lack of vital force in the intestinal tract; those who contract tuberculosis, pneumonia, etc., to a lack of resistance in the lung tissue, and so on through the entire list of "germ" diseases.

Chiropractic goes several links farther back in the chain of cause and effect. While the germ theorists stop at the susceptibility of the patient, the chiropractor says that the susceptibility is the result of a lack of vital force, due to pressure on a nerve caused by a misaligned vertebra; and that when the vertebra is adjusted the normal vital force will again flow over the nerve, the affected parts will again become normal and the disease germs and every other incidental effect will disappear.

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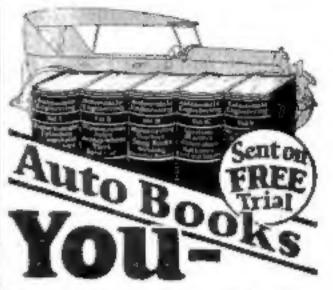
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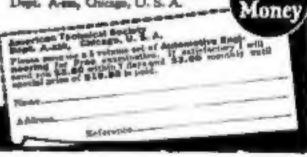
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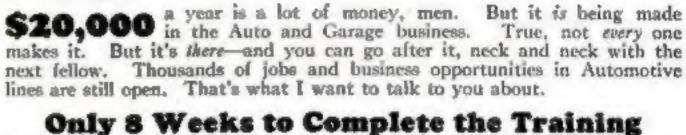
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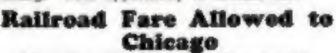


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To win one of these cash prizes is easy, and every reader is invited to enter this fuscinating competition. Just write a letter of not over seventy words answering this question

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Here are the prizes we will pay for the ten best letters answering the above question.

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First read every one of the "Money Mak ing Opportunities advertisements on pages 10 to 79. Check the ones that interest you. Then read over the ones you have cherwed and decide on the one that in teresta you mont

Then write a short letter, not more than seventy words, telling us why the advertise. ment you pick interests you most. Remember that ten prizes will be awarded. You have a good chance of winning one of them. Be sure to mail us your answer before Dec. 1st. The prizes will be awarded in the order of their merit, for the letters that are most interesting and best expressed.

The names of all the prute winners and the letters that win the first two prices will be printed in this column in the February issue. Address your prize letter to

Contact Editor

POPULAR SCIENCE MONTHLY 250 Fourth Ave. New York City

Last Month's Prize Winners

The first price of \$10.00 goes to Mr F C Phillips of Cincinnati, Ohio, for his letter regarding the advertisement of the Press Reporting Syndicate. Mr. Phillips' letter follows:

Dear her here have not been recommended by the second of t

The winner of the Sex not Prize \$5.00. Mr N K Re a se Nouve to K Pa M. Response white a more to an or to an or service of the Novelty Carlety Company Here is a s letter

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The Third Prize goes to Mr. R. Melrose, St. John, N. H., for his letter on the advertisement of the Metallic Letter Company

The winners of the other seven prizes are

C. E. Volbers, Teers Hauts, Ind., Miss S. Rice, Starling III. Kenneth Tetres, New Providence, N. J., Me S. Sesy. Duris, Oblahama, H. A. Mincher, Toungelson, Ohio, E. C. Aembruster Oak Park, Ill., Miss R. South, Monrosis, Cal.

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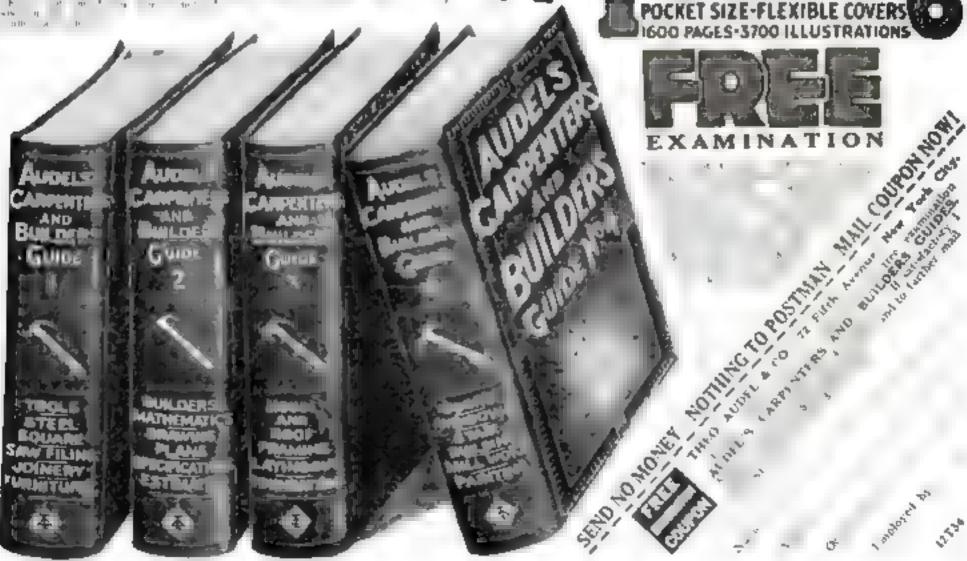
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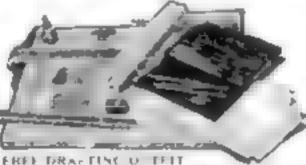
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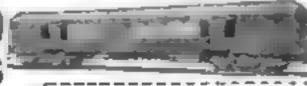
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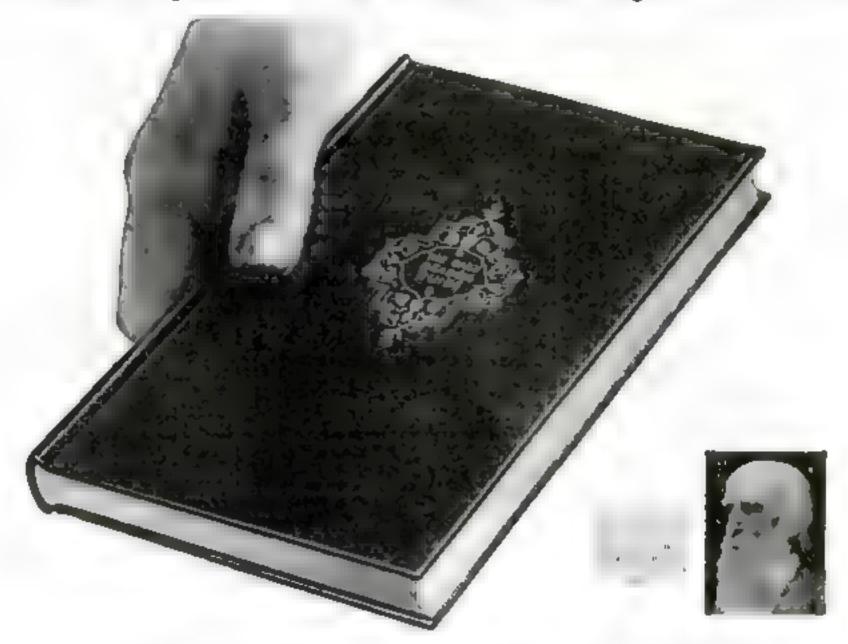
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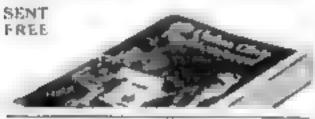
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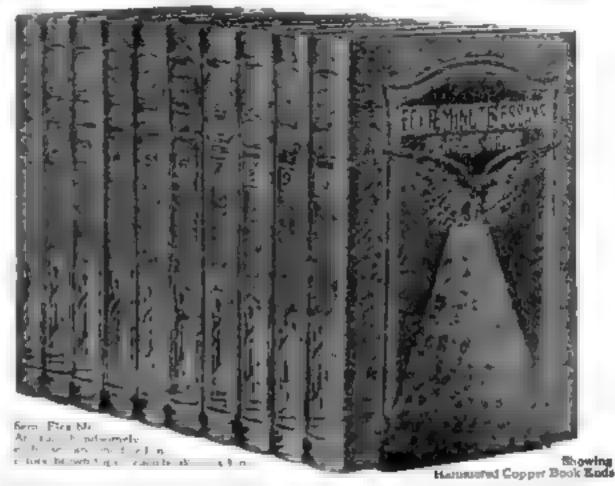
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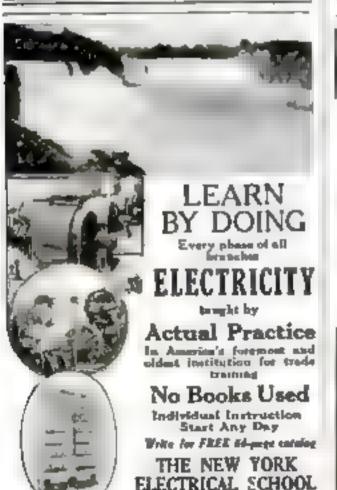
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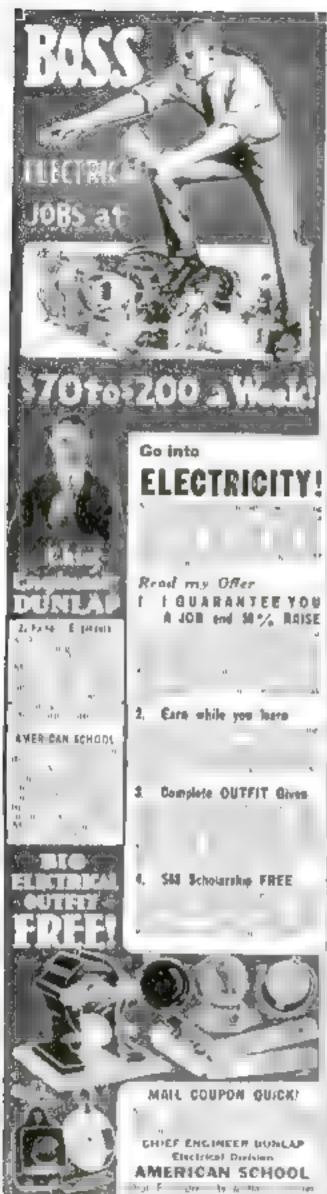
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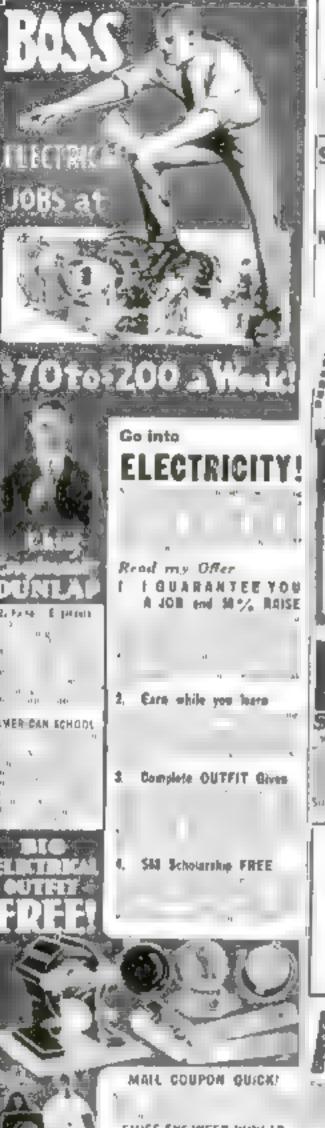
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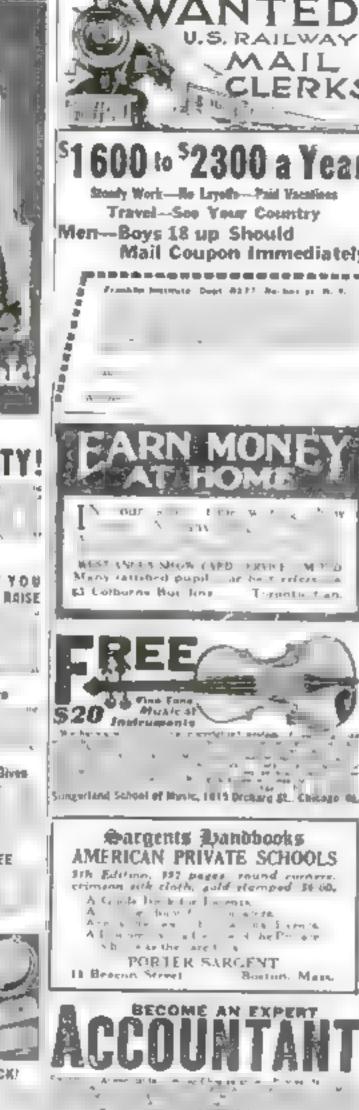
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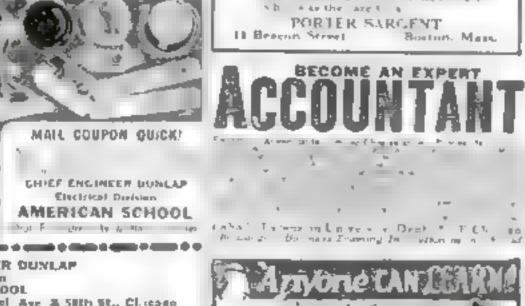




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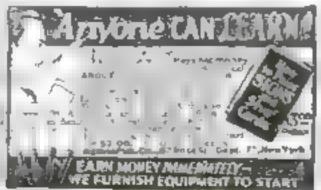
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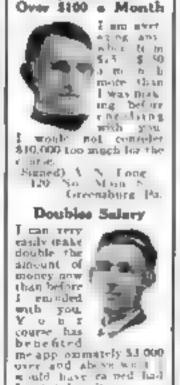
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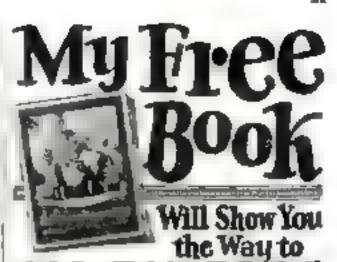
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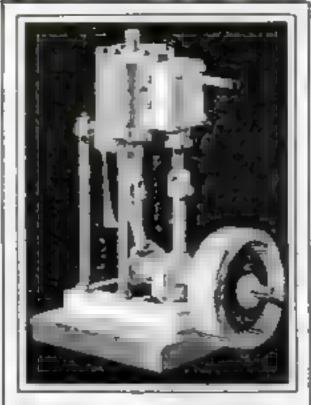
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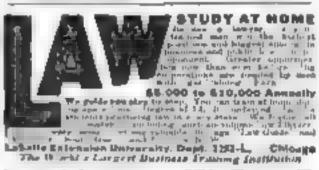
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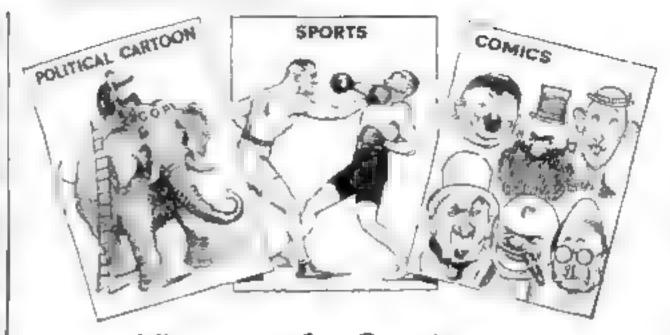
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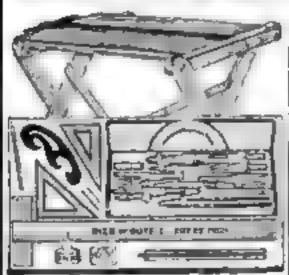
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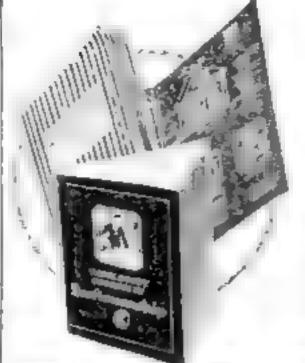
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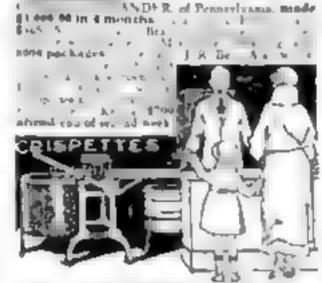
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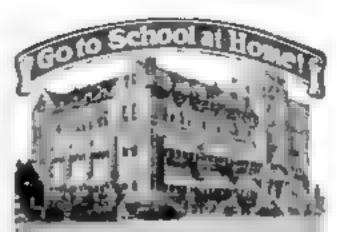
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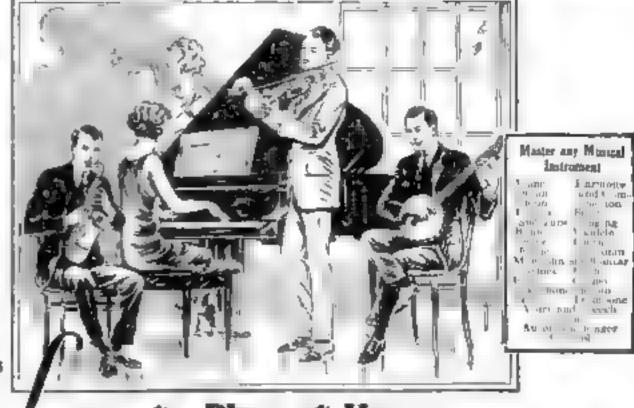
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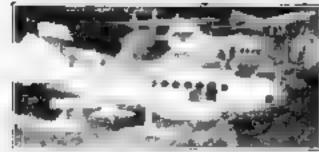
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- if. Does thinking use up the thinker senergy
- (9. Which imsels fawer electricur or hebi-
- What simple test will distingough wood from cotton."...
- 21. What makes the prize of theo-
- 22. Why would men ultimately authorate of all the green plants were killed
- 23. Does the botling of water removing the impurious in it
- 24. Hope do the living cells of the body and the course with which to do their work?
- 25. How is the speed of light mea-

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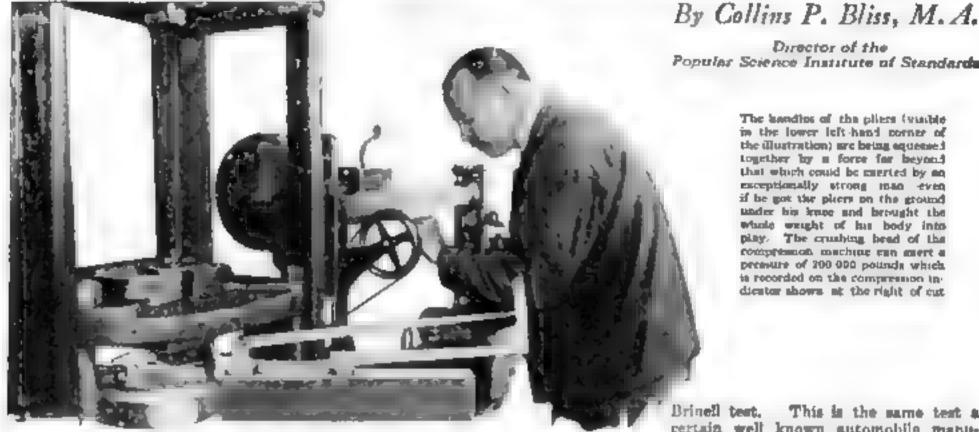
m place of Headphonea. No batteries required No ad untrients

Pliers Tested beyond Human Strength

Director of the Popular Science Institute of Standards

> The bandles of the pliers (visible in the lower left hand corner of the illustration) are being equenced together by a force for beyond that which could be merted by an exceptionally strong man even if he got the phers on the ground under his impo and brought the whole weight of his body into

> play. The crushing head of the compressed machine can mert a pressure of 200 000 pounds which is recorded on the compression indienter shows at the right of cut



I LERS are intended to be used as pliers. Many people ignore this fact and unreasonably expect them to substitute for hammers, crowbars, etc., an the occasion demands.

It is because such misuse is so common that pler manufacturers are compelled to adow a "margin of cafety" in making such products, and the Institute of Standards has been obliged to devise laboratory tests that will bring out the characteristics of plier manufacturing hest suited to meet abuse as well as to give true service.

The accompanying Illustration shows the test used to determine the following three points:

1. The strength of the joints.

The strength and stiffness of the handles

3. The loughness of the knife portion. The latter test is, of course, employed only in the case of side-cutting pliers.

The crushing head of the compression machine shown (which is capable of exerting a pressure of 200,000 pounds, if necessary) travels down, squeezing thu handles of the pliers together. This produces a turning movement on the hinge, forces the knule edges together, so that if the steel is too hard and brittle, they will crack; and it also produces a cross bending of the hundles. This force is exerted until the handles have been squeezed together so that they are onehalf meh closer at the extreme ends than when put in the testing machine.

This half inch is accurately measured with calipers and the pressure then relieved. The handles should return without any permanent set to their original position. If, to any appreciable extent, they do not, the plient are rejected by the Institute of Standards.

Tests made at the Institute of Standards laboratories on some six-inch pliers have proved their ability to stand loads of nearly 500 pounds with only onesixteenth-inch permanent set. This is far beyond any load that could be exerted by even an exceptionally strong man. Pliers so tested have kept their cutting edges true and the hinges have worked perfectly, which point is proved by opening and closing when holding one handle with the thumb and three fingers of one hand while operating the

The toughness of the steel from which phera are made is an important item to determine and this in ascertained in the

other handle with the little finger

POPULAR SCIENCE Monthly Guarantee

The above seal on an advertisement indicates that the products referred to have been approved after test by the Popular Science Institute of Standards.

Popular Science Monthly guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in Popular Science Monthly may aspect that these products will give absotute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this natisfaction by Popular Science Monthly. THE PUBLISHERS.

Brinell test. This is the same test a certain well known automobile manufacturer is now making on all parts of his rar demanding great resisting qualities. The Brinell test is made by forcing a hardened steel hall into the tool under test. The depth of the indentation made by the ball is a measure of the hardness and toughness of the steel used.

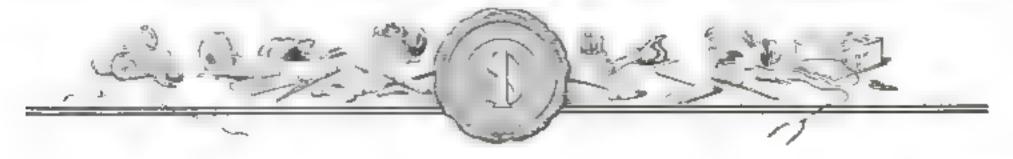
Besides the compression machine tests, the cutting edges of pilers are subjected to a repeated usage test in cutting a number of wire natio of sixes corresponding to the grade of pliers tested, which is determined by claims made by the manufacturer as well as by the size or number.

in testing phere advertued in Popular SCIENCE MONTHLY, the Institute secures representative products from a given line of manufacture. Sometimes in the delicate process of hardening steel, brittleness is caused by over-hardening. For this reason it is impossible for a manufacturer to avoid an occasional pair of pliers proving defective—but practically all are willing to make replacements under such conditions—and if they do not, the Popular Science Institute of Standards will.

It is obviously impractical for aven as completely organized a bureau as the Institute of Standards to test all products hated in tool or radio catalogues advertued in our columns. Only tool and radio products specifically advertised in POPULAR SCIENCE MONTHLY are tested and approved by the Institute,

Send for List of Approved Products

POPULAR SCIENCE MONTHLY will be glad to furnish a list of Radio and Tool Manufacturers whose products have been approved by THE INSTITUTE.







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POPULAR SCIENCE MONTHLY

SUMNER N. BLOSSOM, Editor

December, 1924



The Real Marvel of the ZR-3

An amazing story of duralumin, wonder-metal of aviation, that has made our big airships possible—With two fingers you can lift a girder of it strong enough to hold six men

By Lieut.-Comm. Fitzhugh Green, U.S.N.

EWSPAPERS have devoted considerable space in the last few weeks to the exploits of the ZR-8, the largest dirigible to attempt a transatiantle flight. Talse of

the texts and the flights of the big similip have been told and retold, but the story of the real miracle of the ZR-8, the Shenandock, and other dirigibles is new to most folks. That is the story of duralumin, the marvel metal of the twentieth century—the metal invented especially for

arrehips.

It is a remarkable partnership, this between the mirehip and duralumin. If it were not for the airship, duralumin probably would not have been formulated; if it were not for duraluman, there would be no transationtic or crosscontinent flights by dirigibles. The sirship requires strength and lightness for its ribs and hull. Wood, while light, lan't strong enough. It won't stand the Steel is strong enough, but too heavy. Duralumin is stronger than wood and much lighter than steel, in fact, about one-third the weight of the latter, So light and so strong is it that you can pick up with two fingers a girder of it that

will support six men. Duralumin is an alloy of copper, manganese and magnesium, with about 94 per cent of aluminum. In "strength-weight" efficiency, that is, in strength and light ness, it is 17 per cent greater than a good alloy steel and near y three times better than mild steel or balf hard aluminum. It was first made by Alfred Warn in Germany in the development of Zeppelin mirships, but is now being made in England and

the United States.

Engineers talk among themselves of a Duralumin Age. They speak of vast quantities of fuel saved by lighter engines. trains and motors; of buildlegs 4 me. high; of mechanical wigardry in manufacture: of a world unabackled from ponderous iron and steel. At this moment a large American corporation is seeking permission from the government to use

the power at Muscle Shouls to manufacture this metal for railroad uses, That the thoughts of these engineers are

not mere figments of imagination is proved by the visible evidence of the marvelous qualities of the metal in the extraordinary performances of the ZR-8 and the Shenandouls, as well as the tests of the Firth the Navy's first all-metal surplane,

constructed entirely of duralu-

THE principle of assemblage of duralumin girders in our great alrabips is exactly that which goes into the construction of a battleship. Every element not only supports its own quota of local weight, but contributes directly

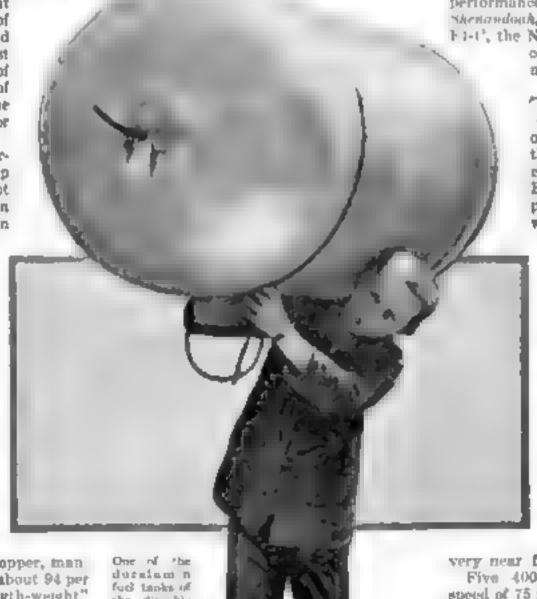
or indirectly to every other e'ement in the whole ship. Thus we have a unfied structure that, as the Shonandosk amply proved, can withstand the buffets of a hurricane.

Statistics of one of the new duralumin-framed air mammoths are illuminating. Take the ZR-8. Figpres for her gas capacity reached 2,500,000 cubic feet. A ship of a size holding the immense volume of 10,000,000 cubic feet is contemplated. The latter will no doubt be the standard commercial liner of the

very near future.

Five 400-horsepower motors give a speed of 75 miles an hour to the ZR-8. A load of nearly 100,000 pounds can be lifted. This means at least 20 passengers besides crew and personal baggage, Something like 12 tons of profit-paying express can be added.

ET us transacte this into terms of the competitive side of air transport as compared with transcentinental railroad service. At a fare of \$200 a passenger, and considering 72 hours as the coast-toroast schedule, a company operating five ships ought to clear expenses on this side



the dirigible "R 3. It is or aight that a bow carrier F 9230 0 100 one shoulder A steel lank of the same seew a 1 we go three distance en estant. of the business alone. That leaves the express profits to pay unusually large dividends on invested capital. And with the extreme safety of bellum gas, as well as the rapidly increasing ruggedness of both frame and fabric, the "overhead" will be small.

These conclusions are by no means offhand speculation. They are firsty facts

already arrived at by a group of longheaded American business men who recently have organized to start an airways corporation just the moment that our navy's experiments put the official stamp of experts on their plans.

"HERE aren't any hidden gun mounts on our linem of the air Indeed, it can be said that they carry no special passpheromia for tactical with a operation : water- or sir-borns Even that fleet. opertan austority of trimmings so dear to the heart of the soldier and sailor at work, is spalled by the luxury that went into the design of the ZR-3. A colossal stster ship nearly three times as big, already being discussed, will be even more palatial in her fittings. Boft bertha, not bunks; white kitchens, not gulleys; plush chairs and lounges rather and stools benches, are some of the items that confound the eye.

See how the score of duralumin mounts: Airship size no longer limited; mail and passenger service revivified throughout the world, particularly at sea, where no water-horns vessel can compete with her rival in the air; health and comfort of travel-

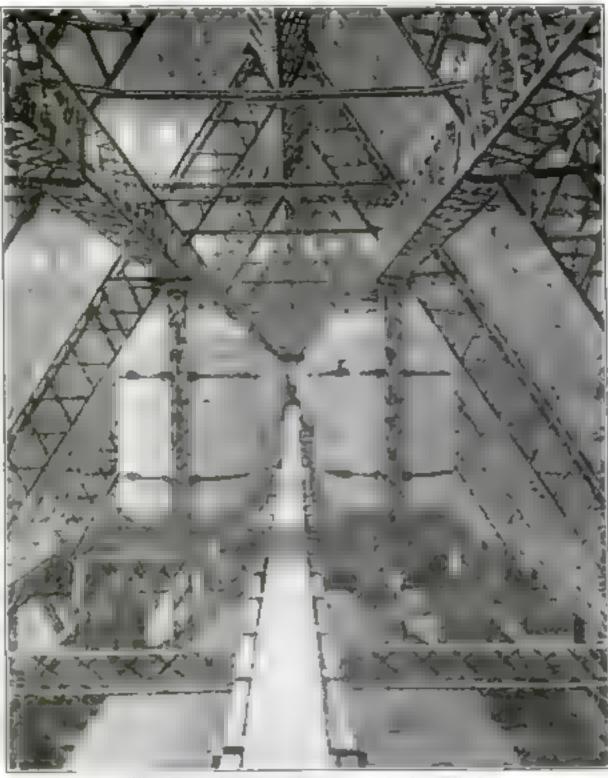
em improved. All traceable to duralumin. made, originally built to bomb New York, and so that survivore clinging to it can

THERE is another aspect of airship travel as distinct from airplanes—that is rarely noted. That is the unsurpassed safety of the duralumin-built dirigible.

No doubt some renders will smile at the suggestion. The fearlessness of the men who prepared the ZR-3 for her Atlantic voyage was well advertised. And justly so, too. For scute interest lay in the perils she faced that were unavoidable in her particular case. The North Atlantic is never entirely free from storms in the autumn. Moreover, while her diameter was greater than either that of the Shence-doah or the Ill-fated R-32, engineers are

not yet wholly sure what dimensions are safest. The R-32 was lost and the Skenardock and R-34 suffered much from the wrenching blows of high winds and from the violent bending forces induced by sharp course changes.

Then there were the specific disasters that make us shudder to recall them. France's reparation Zeppelin, the Dis-



The Duralumin Skeleton of the ZR-3

The rest marries of the ZR 3 - its wast sheleten of dural areas. Every single element of the framework supports not only its own local weight but contributes directly or inducetly to every other element in the entire ship. The wooderful metal that goes into these girden is on light and strong that you could pick up with two fingers a section of it that would support as ment. The strongth of duratumin, to proportion to its lightness is 17 per cent greater than that of a good alloy stock. This photograph shows the fuel tanks in position

made, originally built to bomb New York, was struck by lightning. The British R-32, built to be our ZR-2, broke in half and burnt up on her trials. The Italian Roma, built for our army, was united by high tension wires at Norfolk and cremated both berself and crew.

A LIST of horrors, to be sure; yet atudy of them reveals that the tragedy in each no longer would be possible. Neither the Roma, Dirmede, nor R-32 could have hurned had they been inflated with belium. For the most energetic efforts of our best chemists have so far failed to set fire to this strangely ident gas. Not only that, but belium is a non-comburent; that is to say, it does not

tolerate fire in its vicinity; it is a fire extinguisher

In my opinion duralismin in the most important single factor in bringing about the triumph of commercial airships, but there are other points in my conviction that they have come to stay. One is the anchorage now afforded by the mooring masts, which can hold and protect the

largest durigible in any kind of weather and offer safe haven to the mir-liners in winds that ordinarily would keep them out of hangars. In addition to the safety element, the cost of a mooring mast-\$30,-000, an against \$500,-000 for a hangar-la a big argument for the operation of air-linera from a commercial viewpoint.

BUT mooring maste would have been of no use had not the duigible been rugged enough to withstand the wind and rain Nor would belium have stood for great progress over hydrogen had not its frail goldbeater's skin containers been housed is a structure almost incalculably staunch. Both the ruggedness and the staunchness were wanting before the day of duralumin

Another unexcelled malety feature that distinguishes the mir cruiser that has the light duratumin framework is that she is virtually unsinkable. She has 20--she may have 50emall balloons inside her metal hull. Each of these balloons is filled with gas and is independent of all the others. Each constitutes a lifting unit. Each can form an arrial saft in case of shipwreck. Each can be controlled by valv-

ing so that auryivors clinging to it can drift landward safely. Each is individually inspected, tested, filled, and lashed in place before the journey

Secretly all of us would like to fly, but most of us fear the dreadful roaring of the airplane's motor; the dizzy swooping speed; the possible plunge to death in case of accident. That fear need come no more. Through the agency of the wondermetal, duralumin, the aerial liner will be safer than our floating palaces of the sea.

In the early stages of commercial auliners we shall compare them with the Majestics and Leriathans of the sea. They will be the fast, luxurious vehicles of the very rich. But not for long. Already it is estimated that a three-day service be-



The end of the greatest troyage in the history of six travel. This remarkable photograph above Uncle Sam a newest passenger sirable, the ZR 3, being warped into her hanger at Labeblatet. M. J. ofter completing but recent 5000-mile flight arross the Atlantic from Prindrichshafes, Germany,

This great air-liner is 663-20 feet long and has got capacity of 2 500 000 cubic feet. Driven by five 400-hornepower motors, she can attain a speed of 75 miles an hour. With her hage covelope supported by a skeleton of durahamin girders, she is built to will stand the buffets of a hurricana.

tween Europe and America of air-liners carrying 50 passengers and charging only what the steamships now charge, would be a financial success. A coast-to-coast service in the United States is said to promise financial return on mail and express alone.

Already, too, definite plans are being formulated for linking the nations of the world by commercial dirigibles—plans that include regular simble services between nations of Europe, America, Asia, and Africa. France intends to use the air-ship in developing her African colonies. Spain is contemplating weekly four-day flights between Seville and Buenon Aires England is talking of an airship line to India and the Far East. For all such

tween Europe and America of air-liners projects, of course, dirigibles twice as carrying 50 passengers and charging only large as the ZR-3 would be required.

There is more to be almost an immediate demand for the "excursion air-liner". There is a passionate wanderlust in all of us that there is a view of strange lands.

A horde of new interests will be aroused. Geography will take on a new significance. New mountain resorts, hitherto inaccessible, will be opened. A new and wider sest for such sciences as geology, meteorology, anthropology, physiography and glaciology will be born Sports long neglected, perhaps not yet invented, will be entered into by millions. Mental and physical health of the whole human race will be decidedly improved.

Federal activity will be enlarged and improved. Special Red Cross dirigibles no doubt will be equipped for rescue work in floods and forest fires. Real estate business will take a new start. Larger and more beautiful suburbs will be planned and built. Aerial therapeutics for tuberculosis and other special disorders no doubt will be developed

But let us not forget that the patural laws of aeronautics always have existed; that elements of such worth as helium surrounded Caesar. Not until the ingenuity of a chemist slive today added the final pecessary touch was man master. That touch was derniamin, wonder metal of the age.

"Then the Lion

How it feels to face a savage beast of Alfred Klein, who has spent

work for the man who has killed more lions than any save one, Leske Simpson of California. Mr. Klein has faced death 88 times, and each time won over a raging beast. Eighty-eight lions, roaring, crouching, springing! All of them he shot—more than a score of them just

off the end of his rifle.

When young Alfred Klein left the quiet rooms of the American Museum of Natural History to go to Africa for specimens, naturally, he looked for some adventure. But at that time he never dreamed of all that was before him. For 14 years he remained in the jungle, far from civilization; but when be came back, be brought with him in a big box the high lights of his experiences during that time-20,000 feet of film, remarkable pictures of native hunts, murders, ecenery, game; all the result of limitless patience, endurance and courage.

strutted around in the latest style of sports clothes, and went out once in a whi's to shoot a lion from a 'boma.' This is a kind of shelter made of brush, just hig enough to conceal yourself and your gun. Outside this, you put a kill—the body of a zebra or cow, and then you wait for a lion to accept your bait.

"These 'boma' hunters were the ones who made most fun of the hounds. They said, 'Rainey thinks he's going to hunt rabbits.' I was to take Rainey out for

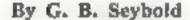
lions.

"NOW, if any one thinks that hunting lions with dogs is easy, let bim try it. Men at the hotel imagined that all we did was to follow the hounds until we were is night of the lion, then pot him. So we took some of these men with us one day. They rode along with us over the thorn brush, fulling into holes and getting scratched trying to keep up with the dogs, and then, at length, we came to the lion.

"There he was, crouched, with tail lashing. He let out one big rour. Our guests from the hotel gave one look, then

turned their horses abruptly and departed. Shooting a lion from ambush is far different from shooting one

Alfred J Wirin, expert merkerses and pioneer big game hunter with one of the hi ilom he killed during 14 years in the jungles of Africa



"FOR eight hours we had followed a hon along a river bed, trying to get him in a piace where we could take a good picture. It was in the heat of day the stifling, killing heat of the African jungle. Our horses were tired, and the lion was tired. At last he went into a little clump of brush.

"I thought I saw him, and being impatient, picked up a big stone and threw it at him. I was right. I had seen the lion, but more important, the lion had seen me, and had seen me throw the stone. He didn't care about the rest of the party. He was after me. He sprang through the air, a roaring, burtling muss. It was my chance to get a picture of a charging lion. I fixed my camera. I heard two shots and then the lion fell dead directly at my feet."

One such adventure would provide most of us with thrill enough to last a lifetime, yet it was only part of the day's

The first two years of his adventures in Africa he spent learning the language and the laws of the trail. After that Klein became a professional hunter and led expeditions of sportsmen from Europe and America. On most of these hunts he took moving pictures. The famous films that Paul Rainey, the late American multi-millionaire sportsman, brought back from Africa in 1912—the first moving pictures of wild animals ever taken on the East African coast—were part of his

Paul Rainey was indirectly the cause of many of the exciting adventures that Klein experienced, for he was the one who first introduced hounds into Africa for hunting fions.

"I shall never forget the time when Rainey appeared in Nairobi," said Klein, "with a pack of American hounds. You should have heard the ridicule of the crowd of sportsmen at the Norfolk Hotel there. Royalties who had come down to hunt had attracted a group of men who facing you -one who knows you are his enemy and must be destroyed if he is to live."

Kiein is a small, slender, wiry man, with taut muscles trained to give instant response. In the jungle brains are what count, not brawn. Many a time an extra 10 pounds is a great handicap. On a hunt one day Mr. Klein was thankful that he was not in the heavyweight class.

"FOUR of us were hunting one morning at dayhreak," he said "Some lions had attacked a pack of hyenns and made away with them. When we found the stripped carcasses, the hounds gave tongue and followed. There were five couple of hounds in the pack to begin with, but they came to a place where the trails of the lions divided. The four lions had gone in three different directions. The pack separated, so there were dogs following each of the trails.

"When we got to the parting of the ways, we didn't know what to do. There

Sprang at Me!"

in the jungle—Thrilling adventures 14 years hunting wild animals

weren't enough dogs on any of the trails to really help in a showdown if the lion attacked. Finally, we decided to split into two pairs and follow two of the trails. Eric Shelley was my companion.

ON OUR trail the hounds ran the lion up a mountain. He went clear to the top, then down the other side, which was a regular precipice. We started sliding down on foot over the rocks. The rocks slipped and it was all we could do to keep on our feet and hang on to our guns.

"Partway downhill there was a ledge

about 10 feet square, covered with dense

brush and in this the lion was hiding.

We found there were only two hounds,

They were practically useless, for two

dogs wouldn't worry a lion more than a

flen. They were exhausted and milent, so

they didn't help us any in locating the

Bon, who was quiet, too. We knew that

he was within a few feet of us. He could

see us, and we couldn't see him. If he

"Well, he decided, and decided quickly

I was still aiding when out he charged,

and he meant business. Shelley was a

decided to leap, we had little chance.

A group of African natives, armed with stronge ovapons with which they hand foots. This carthod is dangerous, and many natives lase their lives every year in close conflicts with the savage beasts

Mr. Elein's photograph below showing a tem summing himself in his time has been pronounced the most remarkable partises of a wild lion grantalose.



yet. He was better than any monkey you ever saw "And I—I went up

atree. There are times for bravery, when you stand firmly on your feet and dely the world; but this was not one of them. That lion was too close for me even to lift my gun and aim.

"I made a world's record climbing that tree. I had just got

a start when I suddenly found I couldn't move. Something was holding me back firmly. The lion had got me, I thought. Then I saw it was my hunting knife, attached to my belt, which had caught in a limb. I gave a great wrench, the knife was pulled out of the sheath, and I went on climbing.

"I had my gun with me. Have you ever tried climbing a tree with a double-barreled gun? Finally, I got as high as I could and looked down at the lion tearing around below. I saw Shelley on his perch on the rock. The dogs were

excited by this time and the lion left us. We let him depart in peace."

Klein's eyes twinkled. "His hide is one that I did not bring back with me to America."

One of the best pictures Klein took was of a lion being killed with spears by natives. This, he explained, was the result of days and weeks of work.

"THAT is one of the most difficult things to get," he said, "for yea never know just where the lion will he. In these hunts each savage has four weapons—in his left hand a big shield, in his right a spear, and on his bolt a thick club and a sword

"The natives run the floa down on foot, then all jump at him at once, spearing him any place they can. I have tried again and again to get good pictures of this, but the floa rurely fights just where you think he will. He turns and charges just outside the range of the camera. Or, sometimes, he comes too close. Then you are thankful for the size of the camera in front of you."

Many have slandered the lim by asserting that he is not "King of Beasts," but (Continued on page 157)

the rocks. How he did it, I don't know

Another of Mr. K con's enterordinary photographs, showing
y water and us be the unity class up
parture of its blad ever obtained

Speedy New Motor-Hoop Amazes Italians

Policeman's Strange Invention Runs from Milan to Rome

By Giuseppe Gagliardi

SPECTATORS at the speedway before the National Stadium in Rome, Italy, gasped with amazement not long ago when they saw a buge wheel, driven by motorcycle engine, careening at high speed around the track like an

overgrown toy hoop. Within the wheel, apparently unconcerned at the possibility of being precipitated in the mad whish, they naw a driver, his hands gripping an ordinary automobile attering wheel, his feet resting on ordinary motorcycle pedals.

Him body kept the wheel in perfeet balance. At every turn he would lenn to one mide or the other. And when the spinning wheel finally stowed down and came to a stop, he simply rested both of his feet on the ground, then let down a standard to keep the wheel from toppling over!

The driver of this remarkable vehicle was Davide Gi-

slaghi, a motorcycle officer of Milan, Italy. Possessed with the idea that one wheel would be more efficient than two, he had perfected what more than one inventor before him had attempted unsuccessfully—a one-wheel cycle that actually would run!

IN RECENT years there has been a marked tendency to reduce the size and weight of motor vehicles and their parts. The light, speedy cycle-car is one example of this development. But this Italian inventor seems to have arrived at the irreducible minimum. He could hardly hope to travel on less than one wheel, and he has left just enough room in his odd car for the rider to sit and drive, leaving luxury or comfort, of course, out of consideration.

Only one tire to puncture, only one wheel to push out of the mud, a lessening of resistance—the owner of an automobile or motorcycle can think of many advantages possessed by a vehicle that can run on one wheel instead of two, three, or four.

The unicycle, which is called a "velo-

cita" by its designer, and also a "motormota," has two principal running parts a large pneumatic tire and an inner hoop of steel. The inner circle carries the driving mechanism and the driver, while the

Two of the odd new motor-house before the National Studeurs at Rome. Italy Notice how the outer rim with its tire moves on rollers about the inner steel boop which is held stationary by the weight of driver and engine. At the right is the investor Downdor Granghi enjoying a ride in his strange vehicle

tire moves around it. The dismeter of the wheel varies according to the height of the driver, but usually it is about five feet. A short man has a smaller wheel than a tall man.

Since economy in size is a primary consideration, the wheel is always made just large enough to prevent the driver's head bumping against the circle.

The air-cooled motor that drives the wheel forward, and its accessories, are fixed rigidly to the inner steel hoop.

The motor, the driver's seat back of

It, and the driver himself, are grouped in a small sector of the circle. On the outer circumference of the steel hoop are rollers, and these support the run of the tire. Thus the two concentric pieces, boop and tire, are independent of each other as the wheel moves forward.

WHEN the machine is moving, the inner hoop is kept stable to a great extent by the weight of the engine and driver. But opposing this, there is a friction roller, driven by the vehicle's motor, which acts against the rim of the tire and revolves it. This force is more powerful than any retarding resistance.

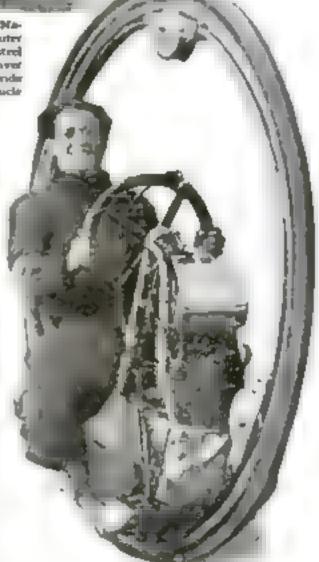
So it is that the driver does not turn with the wheel, but maintains his upright position. He balances the machine much as he would a motorcycle, and he regulates the direction to be taken by the vehicle by inclining his body to the right or left and by a steering-wheel similar to those on automobiles. To keep the wheel from falling when it is not in motion, there is a special stand that fits inside the circle and can be released.

The motor actually travels on an endless circular track furnished by the revolving of the wheel.

When the inventor completed his machine in a small workshop in Milan, the device was not considered seriously by

mechanics and engineers. They thought it simply a toy or povelty, incapable of being used as a practical method of conveyance. So Gislaght made a wager that he could travel in it at high speed from Milan to Rome and race in it before the stadium

He won his wager and then gave several other satisfactory demonstrutions that convinced spectators that what they saw was not a frenk toy, but a vehicle that actually could be operated successfully. The inventor now is experimenting to increase the speed of the unleycle, whose possibilities for apeed as well as everyday utility he believes are almost limitless.



Mud Torrent Ruins Farms

Mt. Shasta Glacier Melts, and Sweeps toward California Towns



Toys that Have Helped Men to Great Success

Interesting stories of the boyhood of famous leaders and inventors— How playthings affected the careers of the Wright Brothers, John W. Davis, and Admiral Moffett—A noted manufacturer tells how to buy the right toys for your child

By Ferdinand Strauss

Orville and Wilbur Wright; a sort of biography that included some interesting details about their childhood. Among other things, it told how the two little brothers in Ohio used to play with balloons after school hours.

Of course, every person has played with balloons at some time to his life.

The light, gally colored spheres are pretty, and there is a fascination in letting a gas-filled one go up and pulling it down again—a feeling of power because you can control it by so slight a motion of the finger.

But the Wright boys played with balloons more than their playmates. They experimented with different sizes and floated them at various beights, to watch how the wind blew them. In playing with them, they never dreamed that they were to be the men to introduce, through heavier-than-air planes, an antirely new method of transportation that would thrill the world.

I was impressed by this narrative, especially, I think, because as a manufacturer of toys, I have long been interested in the effect of playthings on a man's career. Again and again I find, in reading of the childhood of famous men, or in speaking with them, that they spent their play hours with toys that had some definite connection with their later occupations.

IF LINDENTHAL or Modjeski, the great bridgebuilders of today, were to tell you of their childhood, I'll wager you would learn that as boys they spent at least 90 per cent of their time making toy bridges.

Look back at the boyhood of John W Davis, who at this writing is a candidate for the Presidency. At the age of 10 years he was navigating toy boats on

a brook and organizing the "East India Boating Company," perhaps in remembrance of the dashing hero of Elizabethan days of the same name, who had so many thrilling experiences on the seas. While marshaling his little boats into line, loading and unloading them, John Davis was developing those qualities that he now demonstrates as a leader and organiser.

Or ask Rear-Admiral William A. Modett, Chief of the Bureau of Aeronautics, U. S. N., what he did when a boy, and back comes the answer: "I was must interested in flying kites."

Carl E. Akeley, the inventor and hig-

"A toy is part of a child's education." says Mr Strauss. "Why not give children something that will encourage them to think and develop their latent powers?" Above is a new type of educational toy designed to develop the natural ability of boys and girls in construction and architecture. It consists of combers of standardized building parts, such as walls, flotning, doorways, roofs, and windows. These can be fitted in almost unlimited combinations and designs, from the simplest garage in a skyscraper

game hunter, spent his playtime as a boy with tools. The gift of a folding pocket foot-rule, he says, gave him a big thrill, and with his tools he made toys and useful articles for the house. In the heart of a jungle, hundreds of miles from any source of supplies, a man without ability

for construction is almost helpless. Carl Akeley is not, for as a boy he possessed a toolchest.

Another who used tools was Dr. George Ellery Hale of the Mount Wilson Observatory, one of the foremost astronothers, not only of America, but of the whole world. Among his favorite toys were model engines, yachts, and other

> machines that afforded opportunity for mechanical construction

> When he was 10 years old, his father gave him a toolchest, and this became the nucleus of a small workshop that he built eight years later. He had a lathe, a acroll saw, a microscope, a camera, a telescope, and other tools and apparatus with which he equipped a small laboratory. There he began to design simple physical and astronomical instruments. Doctor Hale still uses some of the "toys" of bis boyhood.

ARE not these examples sigmilesni?

As a child, I was extremely interested in mechanical play-things. I can remember that I was never so happy as when I would pull my wagon around town packed full of the neighbor children. I was so much interested in toys that when I became a man, ready to choose my work, I couldn't give them up; so I started in the toy business.

The child who is interested in electrical toys will understand better throughout his lifetime everything he reads about electricity. The boy who spends his time with tools will not necessarily become a mechanic or carpenter, but he will, at least, develop into the "handy man" who is equal to any emergency about the house. Few realize the great importance of playthings in developing genius and craftmanship.

Occasionally I have watched parents and fond relatives wandering about simlessly, just before Christmas, in the toy departments of big stores. They finger this toy and that worriedly, and finally end by buying something—anything—at the counter that is least crowded.



Ferdinand Strates, a plottest in the invention and manufacture of American mechanical toys, is 59 years old yet not too old to be passionately fond of playing with his creations "making the wheels go round." This passion for the creation of playthings—for humself and his companions—has been with him ever since his boyhood days in the little vineyard town of Gollheim Bavaria. When he was 18 years old and a university graduate Strauss came to America. His first position was that of a sample buy for a contern that made and said summer wearing appared, and his

minery was three deflare a work. It was not long before the young man who kked to play with toys tired of this work. He left his position went into business for himself and popularized the harmonics. From that it was but a short step to the making of mechanical toys and it this field he achieved his greatest success. This success he has built on the theory that the child is father to the man, and that the selection of toys for children to play with should be made with this idea is mind. The photograph shows him with some of the newest of his ingenious mechanical playthings

Such parents lose a great opportunity by neglecting a chance to help their children. A toy is part of a child's education. Just an educators choose textbooks, considering carefully the needs of the child, so should the parent choose toys. He should think it all out before ever going near a toy store

Johnny is 10 years old. What sort of toy will help him most at his particular age? In what sort of thing is he most interested — mechanics, electricity, or something else? And what will amuse him most? What will give him the best time? The boy is going to spend his play hours some way during the coming year. Why not give him something that will encourage him to think and develop his latent powers?

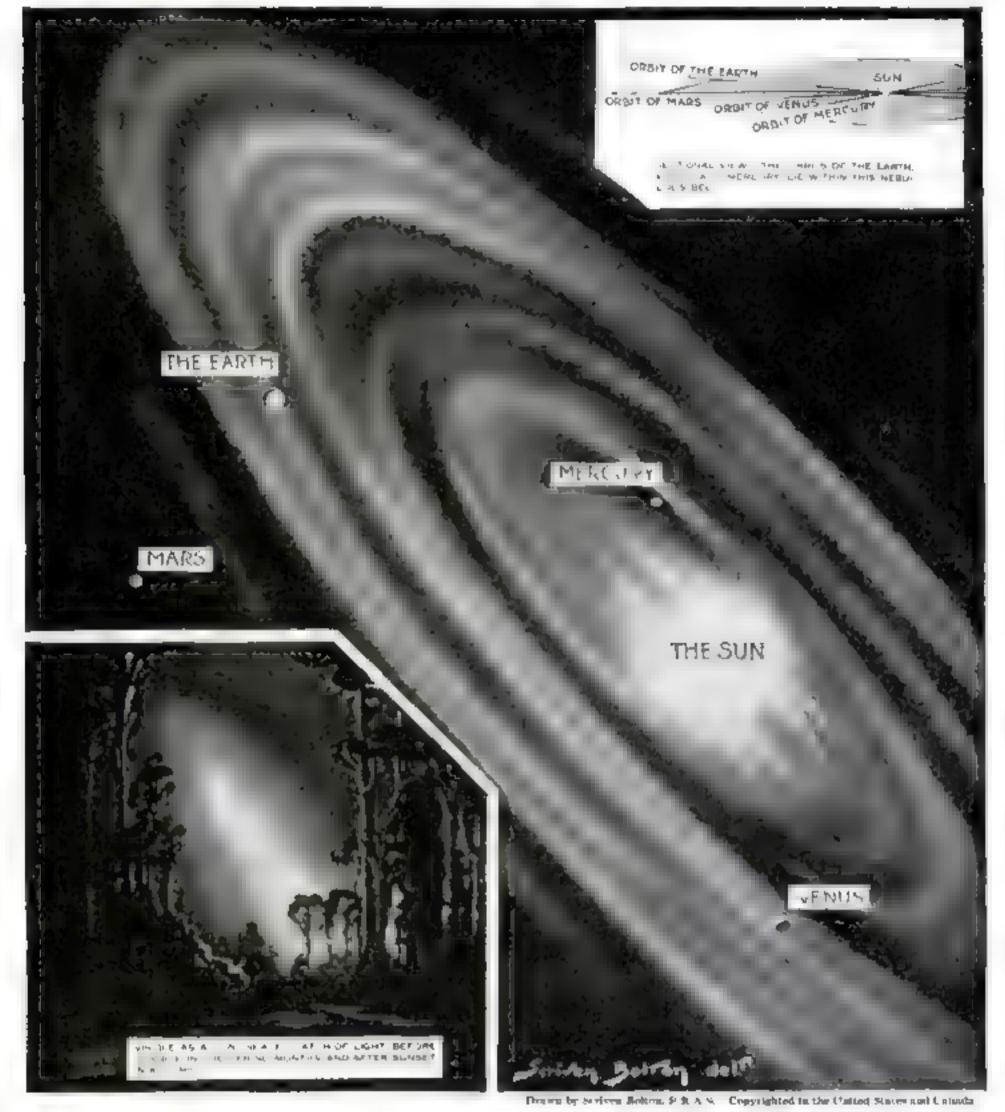
America maket toys that teach something, because it has advanced further in the field of child psychology than any other country in the world, and the psychologists have demonstrated the fact that children learn while they play.

America is the land of playing children.

There are 100 children who play in America to 25 in Europe. The result is that there is little individuality in the children in Europe. They are stiff, unassertive, and afraid of one another. Later on, they don't know how to work well together, because they haven't learned how to play together. Most foreigners who visit us remark the smartness of the American child.

You know how it was in Germany during the war—there were only a few

(Continued on page 163)



A 100-Million-Mile Belt around the Sun

Does It Affect the Weather Conditions on Earth?

By Scriven Bolton

NUSUAL weather conditions in all parts of the world during the last few morths, especially marked by a late spring and early autumn have given rise to the question whether our climate is affected by a vast 100-million-mile ring of matter observed about the sun

This faint, cone-shaped belt of light stretching up from the western horizon

has been visible in clear skies before sunrise during the spring, and after sanset during the autumn. It is known to astronomers as the Zudiacal Light. They explain it by saying that the sun is circled by a huge flat ring of matter, somewhat like the rings of Saturn, and extending into space for more than 100 million miles, far beyond the Earth and its orbit, as shown above. Its position, as seen from the Earth, is always edgewise; hence its coneshaped appearance. The great ring is composed of a huge conglomeration of minute solid particles, or meteoric bodies, having rough surfaces, and shining by reflected sunlight. Like the Earth, each particle moves in its own elliptical orbit around the sun

This ring of matter appears to offer no resistance to the movement of the Earth, lenus, and Mercury, whose orbits lie within its boundaries, or to that of comets.

How Typewriter Detectives Solve Baffling Mysteries

Every letter on your machine offers the expert a clue to your identity-Remarkable stories of a new science

phy (the photographing of documents),

By Fritz Blocki

microscopy, photo-micrography, mathe-VERY day actence is performing matics, and handwriting, are only a few feats that averahadow those of the of the scientific branches that the quesfamous detectives of fiction. Take, tioned-document expert uses in his daily for example, the seemingly imwork; for it should be unpossible task of identifying a derstood that when the exman by his typewriting -runpert asserts that this letter hing down a machine-made clue. or will in nuthentic and that No doubt you read how this was ore a forgery, he does not done in a recent acreational murmerely express an opinion. He must demonstrate the der case in Chicago, when to un-WIT BE expects were a fatestify that certain comes that Loren C. Horton, one of the tended to establish a wartive "unquestionably and rees who to a r see H a strong using no s. seen for a result of the control of the

on a typewriter that had been stolen by one of the suspects and had been recovered by the police from the bottom of a park lake.

That a criminal can be traced, captured, and convicted through a scrap of typed paper, which apparently is just like any other piece of typing in the world, almost challenges credence; yet to the expert on "questioned documents" such accomplishments are in the day's work.

To him a "slim clue" is not merely a figure of speech; he deals constantly with quantities that are infinitely small. To him a difference of possibly a hundredth of an inch in the length of the cross bars of two typed t's carries a graphic, understandable message. Departures from the rules of punctuation reveal to the expert unmistakable peculiarities of the typist's methods. The difference in shading between two typewritten lines may establish as a forgery a document upon whose authenticity the disposition of thousands of dollars depends.

Loren C. Horton, of New York City, is one of the country's foremost exponents of this little understood science, for science indeed it is. Chemistry, documentogratruth of what he says so conclusively that his testimony will be admitted as evidence in a court of law and yet so simply that his processes will be understandable to those who are not scientists—judges, lawyers, and jurors.

The story that Mr. Horton tells of his work is thrilling and dramatic—in its results at any rate, even though those results are achieved by meticulous cure, tireless research, repeated experiment and minute analysis—tho methods, in short, of the scientific laboratory.

THERE is nothing that suggests the detective in the personality of this man to whom each typewriter possesses characteristics as individual as the differences in height, coloring, features, and body contours that distinguish human beings. In appearance be is not unlike John W Davis, and he apeales clearly and decisively with the precision of the man long used to

"Typewriters are no more exactly alike than are human heings," he told me. "All

scientific accuracy

normal people have two arms, two legs. and two eyes, yet no two people are exactly alike, no matter how closely they may seem to resemble each other. Bo it is with typewriters. These show their individuality, not by their appearance, perhaps, but by their written products, or their type equipment. These are as various as the persons who use the machines, though the writing may all look strikingly alike to a layman.

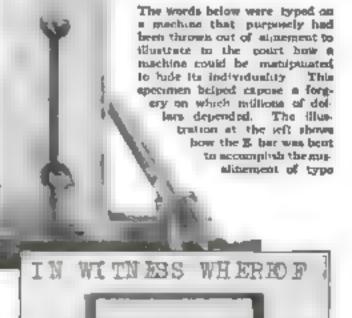
"The various styles of type on various makes of typowriters are not the same; no two sets of type made by different manufacturers are exactly altho in shape."

MR. HORTON took up two bits of typing I had brought with me. He gianced at them and quickly told me that they had been written on different typewriters, though he had nover seen those slips of paper before. Then he had me examine them under a microscope, and by comparing only two letters, the a and the s, I quickly noted a marked difference between them. The concluding curl of the a on the lower right-hand corner curied upward in one letter, downward in the

other. On the letter s, the vertical lines that form the finish at the top and bottom of the letter were straight in one specimen, decidedly curved in the other, These little lines are called

"aemis "

"That gives you an idea of a few of the many points of differ-



ence that may be found in typewriting," said Mr. Horton. "Besides these, there may be a difference in the curvature of the elliptical letters, such as e, e, or capital G, or the angles of w, v, and y may be sharp in one case, comparatively broad

in another. Other differences may be found in the length of the tail of the y or in the length of the cross bar of the t.

"A very slight difference in the length of this cross bar helped to expose a forged will in a case involving several hundred thousand dollars. A few years after a wealthy Chicago man died the manager of his wife's affairs produced an alleged will purporting to have been written four

years after a will already probated.

"I photographically enlarged this document, taking a section at a time. The enlarged photographs and the will Itself as seen under the microscope showed that the impressions of all letters had been very slightly penciled over, a task that must have taken hours. So carefully was the work done that it was almost impossible to detect the change with the unnided eye.

"ALSO, the type

machine on which the 'will was typed had been bent in a way that was most unlikely to have occurred from usage. The inference was that an attempt had been made to disguise the typewriter. However, the writer of the document could not change certain unmistakable characteristics, so I was able to name the make of typewriter used in preparing the alloged will.

"Years after the date of this will the company had shortened the cross bars of its i's. If the will were typed on a machine with short cross bars, it would disclose that the date was incorrect, hence, that the will was a forgery. So it was necessary to lengthen the cross bar on each I with a graphite

penell.

"One letter so doctored would have meant quick detection, but with all lettern penciled, it was virtually impossible to prove that the "s had been lengthened. There were so many suspicious points connected with this document.

however, that it was not admitted to probate.

"In another case a man who tried to after a document with a machine of later data than that with which the original typing was done attempted to change the length of the cross bar on the i by grinding it down with an emery wheel. He succeeded, but only partly, for in doing the work he accidentally shaved the little corl

Three magnified copies of type-written letters, in stencil and in cerbon, reveal the imperfect type faces and uneven type appreciation, that give the specifies that printed them an unquestioned individuality

Prycus o na Pora, p De sant Inc

How many differences can you find in them kneel. They were written by five different persons on two different machines, the top four on a machine of one make, if you look carefully you will see certain distinguishing characteristics of typewriters and imperfect letters. Notice that the fallen a in the fourth line evidently is the fault of the typest rather than the machine for the a u in all the other lines are almed. It is by seizes he study of each perthamber that different typewriters and different typists are identified when necessary to establish, evidence is connection, with disputed papers

at the bottom of the letter. The odd appearance of the resultant letter aroused suspicion, and magnified photographs of the type showed plainly the marks of some abrasive.

"Typewriting is almost as personal as permanship sometimes, due to certain peculiarities or mannerisms that the typist has developed. Such clues may be found in spacing, spelling, or punctuation.

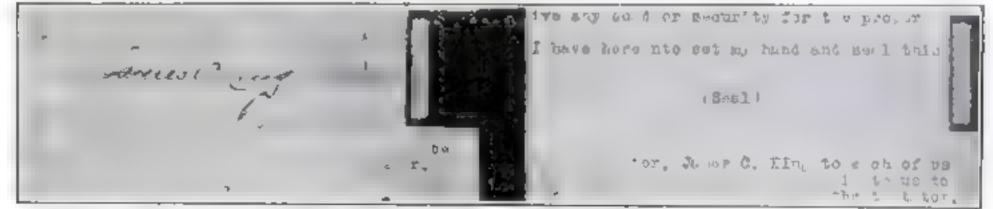
"Some time ago an office of the Department Justice was natonlahed to find a confidential letter from its files printed in a magazine. There was a bad 'leak' somewhere. The letter that had been sold to the magazine was obtained, and was found to be a typewritten copy of the original, the latter having been in longhand. This typewritten copy had so many ludividual characteristics that the copyist might almost as well have signed his name to

it. In breaking a word at the end of a line, for example, he invariably inserted a second dash at the beginning of the next line. Also, he had a habit of following each semicolon with a dash.

"With such personal characterlatics as a guide, finding the seller of the letter was a matter marely of elimination among those who had access to the copied letter.

"NOT only may machines of different makes be distinguished readily, but each machine from the same factory presents individual characteristics, sometimes even before it has been used. I have often examined a brand new muchine and found breaks in the outlines of a letter, or distortions of the serifs, imperfections too small to be noticed ordinarily, yet tremendously important in fixing the individuality of that particular machine. In other cases machines are individualized through the type being 'off its

(Continued on page 106)

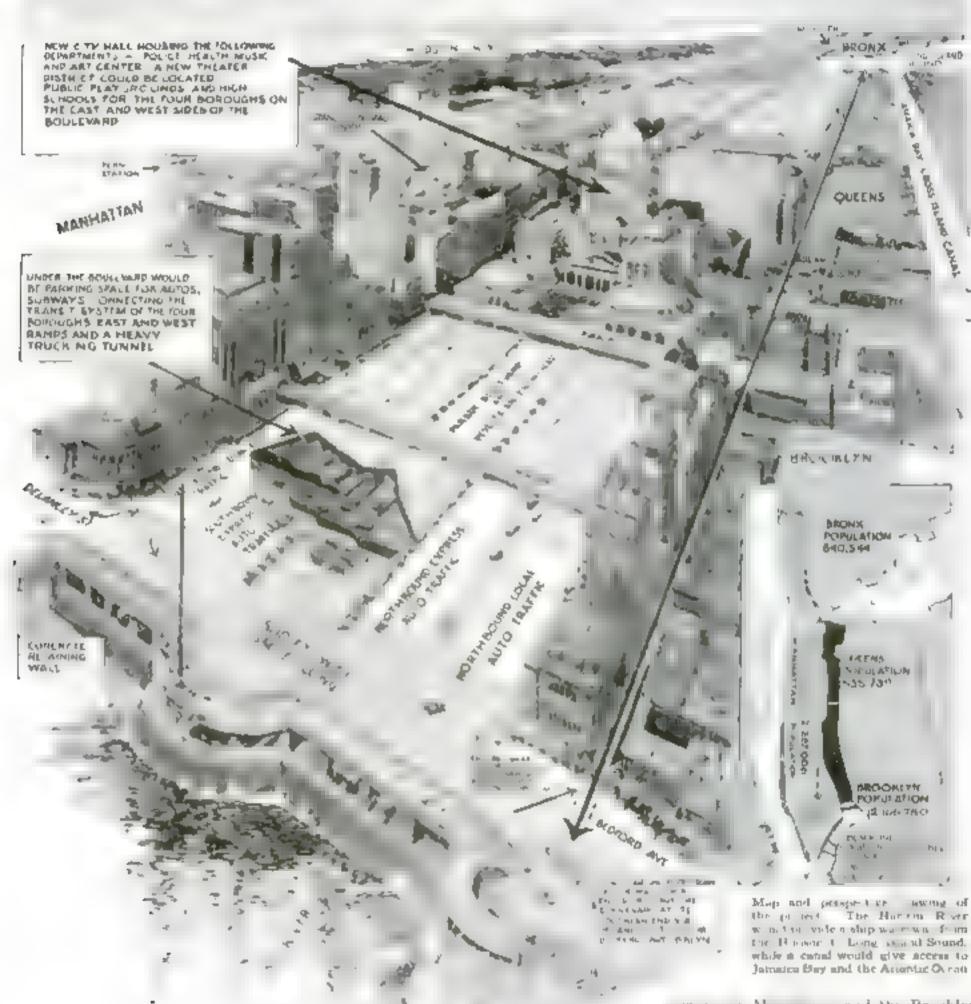


At the left is a photographic reproduction of a disputed will. Mr. Horton testified that every letter in this document had been penciled over. This was done he inferred, to hide the fact that the cross hers of the t s had been lengthened by pencil to make it appear that the document had been

typed on a machine of a model that corresponded with its date. At the night is a copy of the same document. Comparison between the two specimens brought out important characteristics in the typing of the output document and so supplied valuable evidence concerning the will

Plan to Drain a New York River

Vast Engineering Project to Relieve Traffic Congestion



INCREASING traffic congestion in Greater New York City, which is causing a loss estimated at more than \$1,500,000 every day, recently called forth this yest plan of draining the East River and converting what now is a busy waterway into a five-mile system of automobile and motor-track highways, subway lines, parking spaces, and city centers.

This particular idea comes from Dr. John A. Harriss, special deputy police

commusioner in charge of traffic, and is under consideration by municipal authorities. If carried out, it undoubtedly will be one of the most tremendous engineering feats ever undertaken.

The project calls for erection of two concrete dame—one at lower Manhattan near the Wahamsburg Bridge, the other where the Hariem Raver joins the East Raver near Hell Gate. The raver then would be drained, and the 500 feet be-

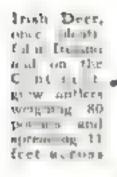
steel uprights. The world a revised a vast traile center on state, joining four boroughs. The plan contemplates removal of noisy elevated structures.

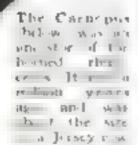
From the river bed would be built subway mes, vehicular subway, taxi stands, conduits, city equipment departments, parking spaces, and private and municipal garages. On the top level would be five 100-foot boolevards for autos and pedestrians. Ramps would provide for cross traffic. And midway along the great thoroughfare would be erected an imposing city hall and community center. 27220

They Once Lived

If the Animals of Today Kept of Prehistoric Monsters

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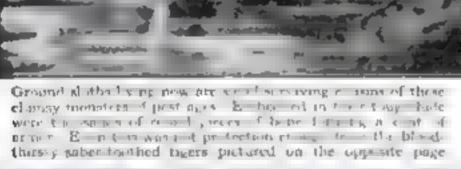
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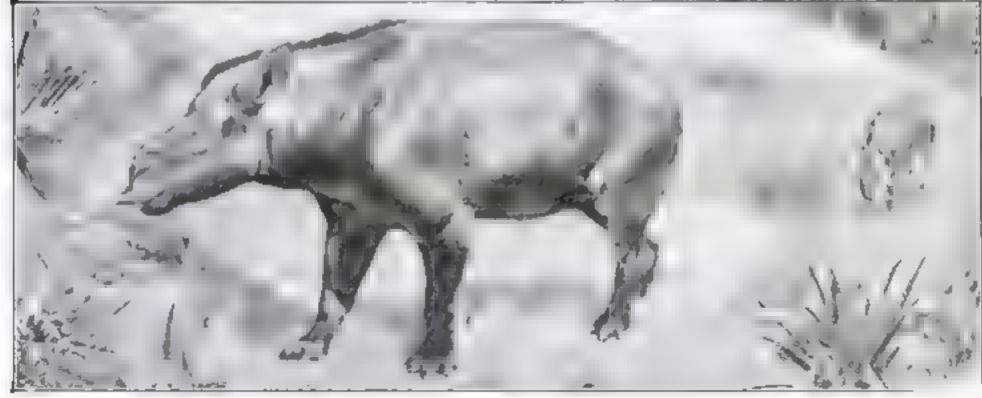




Before the Rockies existed, and when Colorado was as flat as Karasa, the terrible Brontosaurt, or Thunder Lizards, made the western United States their headquar ters. Concenhies one or trakes are the represt existing relatives of these ministr's that ince don ingle! the earth Thunder Luzard was 25 forthough and things high yet ats the a weighed less thon a p and





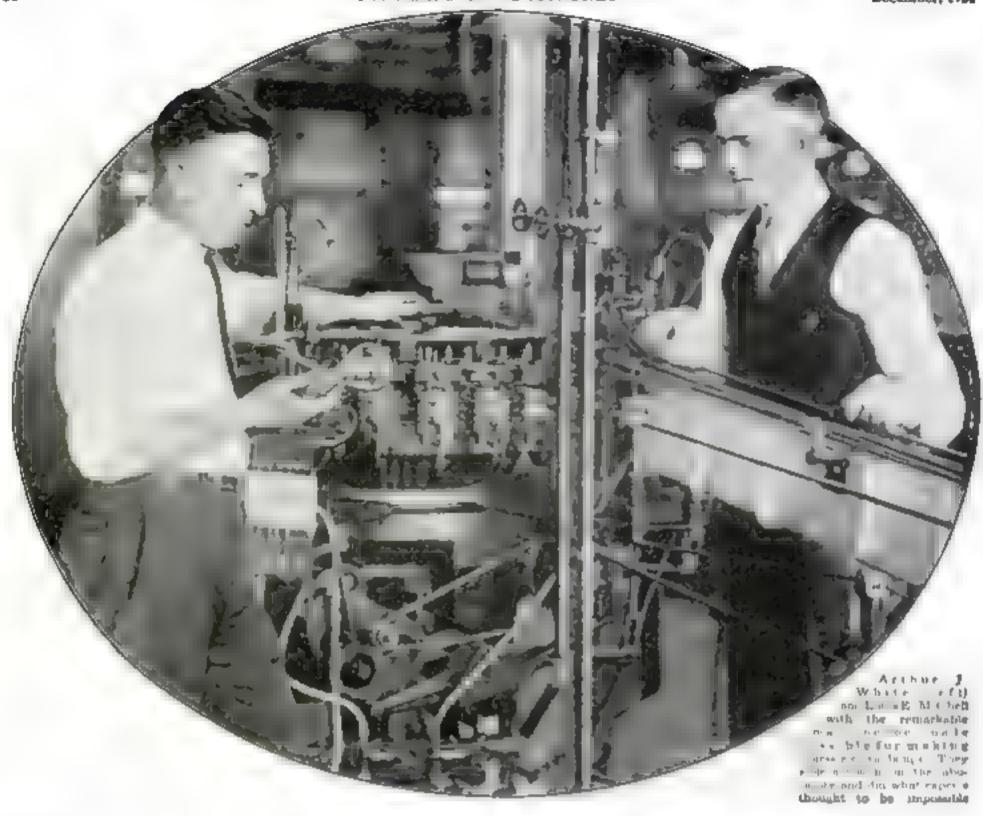


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They Did the "Impossible"

How Two Mechanics Made Tipless Lamps when Experts Failed

By George Appel

J. White, foremen in the Nela Lamp Division, Nela Park, Cleveland, Ohio, recently were given awards by the General Electric Foundation, established by Charles E. Coffin in recognition of outstanding services performed during the year

The awards were bestowed for an achievement that outside the industry went practically unnoticed, yet one that marked an epochal event in electric lighting—the production of a true tipless lamp.

For years experimenters had sought valuely to aliminate the little sharp tip on the end of a light bulb. The tip is what is left after the exhausting tube is scaled off when the air is pumped out of the bulb. It causes more than half the breakage of lamps during manufacture and afterward, because it strikes and catches on things. Moreover, manufacture of tipped lamps involves a highly complicated hand process that is slow and expensive. Altogether, the tip had been a prime numerical.

A remarkable feature of the success of Mitchell and White is that experimenting in not their business. They are employed to work out production methods in lamp manufacture. After experimenters in the Nela laboratories have developed a new type of lamp, and after engineers have developed the machinery, Mitchell and White take hold, organizing the shop system and training the key workers.

In the matter of the tipless lamp, they stole a march on the laboratory staff and did the job some experts thought was impossible.

"WE BOTH have been interested in tipless lamps for a long time," White told me. "A bitle more than four years ago, we had some idle time on our hands between organization jobs, and we decided to see what we could do about those tips

"We tried all the old methods of eliminating the tip, to see if they furnish any practical ideas, but we found they all had drawbacks that couldn't be overcome."

Mitchell, who is round faced and jovial,

and White, who is slim and thoughtfully solems, spoke alternately, each supplying points the other overlooked.

THEN we thought of running a little tube up through the base," they continued. "We thought if we could connect a small tube to the inside of the lamp through the glass standard that holds the filament, we could exhaust it through that and seal it.

"The idea looked good, but we hit a snag trying to carry it out. The tube could be welded in, but we couldn't find any way to punch a hole through the end to the inside of the lamp. I'll bet we tried a hundred ways of doing it, mostly different ways of poxing it through with wires. None of them worked

"Then we tried air pressure. We sealed the extreme end of the little tube and heated it and brought the end and the standard to a plastic state by heat. Just as we thought, the air confined in the little tube expanded enough to blow the hole through. But it wasn't a good pro-

(Continued on page 162)

Do You Know How to Wash Your Hands?

Most of us don't—How
to care for your
skin in the
winter

By Charles Mallory Williams, M.D.

NE cold day last winter a man came into my office complaining of trouble-some itching of his hands.

"I suffer this way whomver we have a cold spell," he told me. "At other times I am not bothered. I don't know how to account for it."

On examining him I found the skin very dry, with a few tiny scales where he had acratched. The skin was extremely irritated, but there was nothing radically wrong with the man. He simply didn't know how to take care of his skin—in short, didn't know how to wash himself—in cold.

weather. He had exposed his hands to the cold and wind until they had become dry and scaly. Then he had aggravated this condition by further drying his skin with hot water and strong alkaline soap.

There is nothing unusual in this case. Few people understand how to protect and care for their skin in the cold of winter. The result is evidenced in the increasing prevalence of chapped hands and wrists, cracked lips, itching legs and childrains in these days of silk hosiery, low shoes, liquid soap, and paper towels.

KNOWLEDGE about your skin, its tremely important, because its condition has a vital bearing on your personal health and comfort. Briefly, the skin consists of a tough layer, like fine leather, which serves to protect the flesh beneath from injury and from cold, and to support the nerves and blood vessels, oil glands and sweat glands that run through it. Above this layer is a thinner, nofter layer, the part which we can see and touch. This is constantly wearing away, and as constantly renewed from below. It has no perves nor blood vessels, so a slight injury produces neither pain nor bleeding Also a slight injury leaves no permanent scar. In fact, every time you wash or shave, some of this surface layer comes off

The oil and sweat glands supply oil to keep the skin soft and pliable. The sweat glands, besides supplying a little oil, secrete water in quantities, depending on the amount needed to cool the body by evaporation.

What happens when you go out into the cold?

First, the blood vessels

contract, causing puller; the skin feels cold and shriveled. Then, if you are fortunate enough to have good circulation, the blood vessels dilate again, causing a flushing and a feeling of warmth. At the same time, the secretion of sweat is checked, to prevent loss of heat that would be caused by evaporation of the water. The skin becomes dry, partly be-

The Mistakes We Make

DOCTOR WILLIAMS, a famous New York authority on the care of the skin, says that we bring upon ourselves much of the skin irritation of wintertime by too much soap and water and too little clothing.

He points out the mistakes most of us make and tells us how to avoid them.

His advice is of vital importance to thousands who suffer needlessly in cold weather.— The Entrop. "If your skin gets dry and harsh is cold weather "tays Doctor Williams." beware of 10'obs ship and but water Wash your bands as little as possible and dry them quickly and thoroughly"

cause less awent is secreted, and partly because what little sweat still is formed is evaporated rapidly by the warmth of the body and the drybess of the winter air

If THE exposure is repeated often, there are changes in the formation of the outermost layer, which becomes more horny than usual, and probably there are changes also in the oil glands. All these alterations are increased by wind, which makes evaporation more rapid and increases

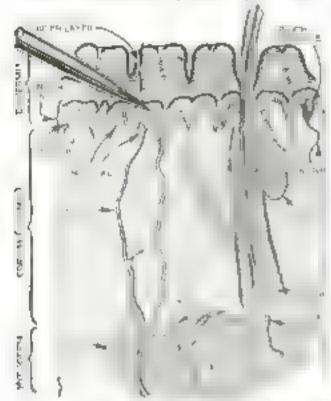
the sensation of cold. There result, then, the sensable effects with which we are all familiar. Thuskin of the hands, especially over the knuckles, becomes a little thicker than usual, and feels dry and harsh. Fine scales appear on the surface, and if these are not shed as they normally would be if they had not been toughened by the cold, they turn a dirty gray.

This change in color appears especially over the albows and knees, and on the skin of the legs just above the shoe-tops. You needn't try to wash this dirty color off, for you will only make the skin tender and help to chap it. The dry, thick skin is not so fiexible as usual. Cracks appear over the joints, especially the knuckees, and there begins an itching that may make your life a burden.

WET cold has a somewhat different effect. If you are run down physically or if your circulation is poor, long exposure to cold and wet, like standing in wet shoes in the slush of spring, may lead to chilblains. These are dusky swellings in the skin, usually on the feet, but sometimes on the hands, which itch and burn abominably when the skin is warmed, but which, curiously enough, become fairly comfortable when the skin is cold. They are tender and sensitive, easily injured, and when once they start they are likely to last until warm weather comes.

If you want to avoid all these extra woes of winter and early spring, you must begin by protecting your skin as far as possible. First of all, don't let it get cold. Fortunately, your face is tough, and probably won't give you much trouble, unless you are cursed with a particularly sensitive skin—then you may get cracked lips if

you aren't careful. Try to keep your hands and feet always warm and dry. Wear woolen or fur gloves if necessary. Above everything, protect your feet



The structure of year user. Beneath the property on noter layers are the oil and sweet glands that beep the skin soft and phable. Too fraquent washing within a water and soap dries and soap dries and soap dries in cold, windy weather

from the wet. The cold of outdoors, of course, is the greatest enemy of the skin, but you may have considerable trouble even if you stay in the house. There it is excessive dryness that you have most to fear.

I REMEMBER one patient, troubled with akin irritation, who couldn't account for the fact that her skin was like purchment, her hands and wrists chapped, and

the linings of her nose and throat dry She said she always was careful to protect herself against the elements on the few occasions she ventured out in winter

On questioning her I found that in the heating apparatus of her home there was no provision whatever for supplying molature to the air. Cold air cannot hold as much water vapor as warm air, and when winter air is raised from 20°P to 70°F without any provision for supplying moisture, its relative humidity becomes as low as that of the desert, and evaporation from the skin is correspondingly rapid. Any means you can improvise to keep the air of your house and office moist, such as placing pane of water on the radiators, will help to prevent chapped hands. It is well, too, to make sure your furnace has some means of humidifying the air If it has not, almost any furnace expert can remedy the defect.

Protection of the skin means more than wearing warm clothes. One of the most important things to guard against is an excessive use of strong soap. Strongly alkaline soaps, notoriously injurious to the skin, are doubly so in cold weather. Even good neutral soaps may be too strong for a very dry skin, and there are many people who find it impossible to take a hot bath more than once a week in winter on account of the intolerable stehing it produces. A cool bath is better, for it does not remove so much of the natural off of the skin.

IF YOU find that a hot bath with scap makes you itch all over, and especially where the clothes rub or press upon the skin, try a warm bath without scap, and if you are still uncomfortable, try the next time, a cold bath.

Each individual must determine the temperature and frequency of his baths to suit his own needs and comfort. Wish enough for cleanliness, but don't overdo it; and be guided not by what others do, but by the reaction of your own skin.

If you are blossed with a sound, supple skin with plenty of natural oil, bothe as

After washing, rub in a little of a good hand lotion. One of the best known is a mixture of equal parts of glycerine and rose-water. This will do very well for most people, but there are some who cannot use it, for they find that glycerine is very uritating. A lotion that can be used by almost every one, is an emuision of olive oil made up with tragacanth. A small quantity of this should be put en the skin and rubbed in until it disappears.

In some cases a good cold cream, or similar preparation will serve better than any lotion. Some people, too, find that pure clive oil does as well as anything. Whatever is used should be applied after every washing, before going out into the cold, and again on coming in. It is better to use a little very often than to use a great deal once or twice a day. All that has been said applies particularly to the hands, because they must be washed more often than any other part of the body, and are most apt to give trouble.

Next to the hands, the part most frequently affected probably is the six inches of skin above the shoe tops. There are

> two reasons for thus: first, it is often insufficiently tected by clothing: and, second, the circulation in the lower part of the leg in very often sluggish. If the local circulation is poor, the local nutrition is poor, and a poorly nourished skin will itch, chap, crack and become infected. where a well nourished skin would remain healthy.

> KEEP the legs warm by proper clothing, and help the circulation by proper exercise. For a local application, the lotions and



Much suffering from skin troubles always follows bitter winds such as their depicted in this New York street scene says Dortor Williams. Too much washing with soap and water and madequate clothing are responsible. Wesh yourself excelully clothe yourself wormly shough, and you need not suffer

much as you please; but if you are cursed with a skin that gets dry and harsh in cold weather, cracking easily, beware of soap and water.

You can avoid a good many washings of your hands by keeping them clean in the first place. For example, wear gloves whenever you have a particularly durty job to do, such as oiling an automobile or tending the furnace. You can't get along without washing, however, so the method of washing and the after treatment are important.

W ASH with warm, rather than hot water, rinse the coap off completely, especially if it is liquid soap, and dry the skin quickly and thoroughly immediately afterward. A wet skin is a cold skin, and a cold skin chaps. In using paper towels be sure they are sufficiently absorbent. If necessary, use several to dry your hands. A clean, soft, dry towel is the only kind that is really satisfactory.

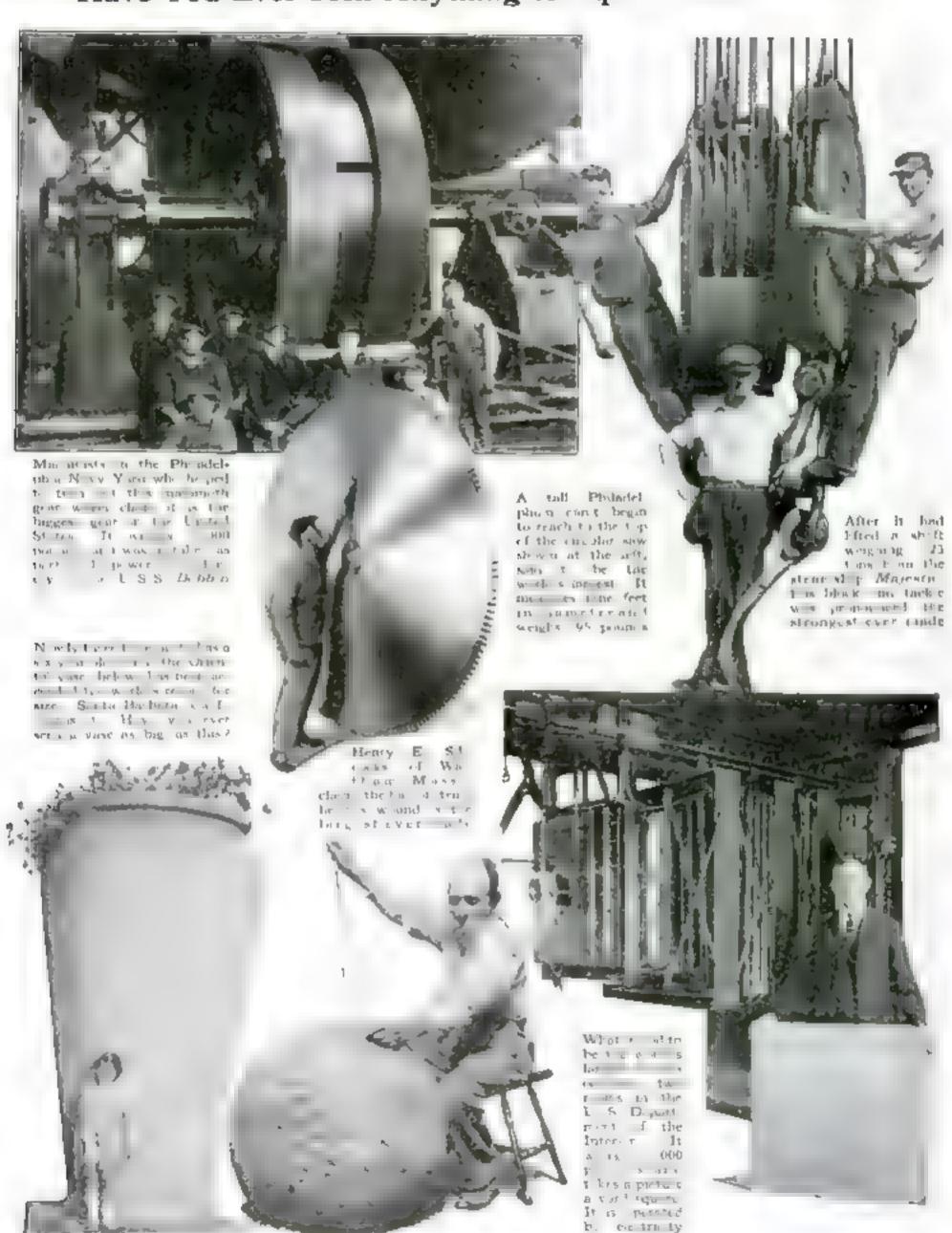


For fronthite, the old-fashioned remedy of subbing the fronts member with abow is an good as it ever was. In this way the fieth thems gradually and circulation is resumed

there is an old-fashloned country remedy that often is successful. This is to rub a (Continued on page 170)

The Biggest of Their Kind

Have You Ever Seen Anything to Equal Them in Size?





THAT better electric generators, more efficient storage batteries, new methods in wire transmission and even radio transmission of power can be expected in the future scarcely need be said. Cortain it is that if engineers find at their disposal any such tremendous source of power as lies in the crust of the earth, they will prove capable of developing ways to utilise it.

It was almost 20 years ago that Bir Charles first brought to the attention of science the possibility of utilizing the

earth's interior heat for the development of power. At the time the suggestion was regarded as an interesting eclentific speculation. Hundreds of scientists since then have discussed the proposal and studied it from a theoretical standpoint. Meanwhile, though, Sir



ANTED: \$100,000,000 to smure manked of all the heat and power that will be required until the end of time!

If you were to read somewhere an advertisement worded substantially as the above, your curiosity undoubtedly would be piqued. Probably if you paused to analyze such a statement you would become suspicious of the good faith of the person who framed it. For it does seem absurd that for an amount of money less than the world's present weekly coal bill, an amount only about three per cent of what is required to run our government for a year, there could be accomplished any such tremendous thing as driving every factory and warming every house that ever will stand on earth

And yet this amazing suggestion is made by one of the world's foremost men, an engineer and scientist who has contributed immensely to the welfare and comfort of the human race. Moreover, his suggestion and his definite plan for carrying it out have been indorsed and declared sound by other eminent engineers.

What he proposes to do on a gigantic scale already has been done successfully in a smaller way. Indeed, only within the last few weeks the United States Government officially admitted the feasibility of the plan by assigning a group of experts to investigate its possibilities.

This man is Sir Charles A. Parsons, K.C.B., F.R.S., the noted British scientist to whom we are indebted for the presentClere valve and steam recording instruments of America a Stat power-generating plant to be operated by natural steam from underground. For this plant, at Healdaburg. Calif engineers tapped an enormous supply of steam by drilling only 300 feet into the ground. The best at the bottom was more than 500 degrees, and at the surface about 350 designers. The steam pressure of the plant emigon up to about 70 pounds

day widespread use of the steam turbine. The way in which he proposes to make man forever independent of coal, oil, and other similar sources of power is by sinking a shaft 12 miles deep and drawing out the tremendous heat of the earth's interior

Now you may raise the objection that were

such a shaft to be sunk, it would be impossible to distribute the resulting power over the whole earth. That is true, today, but you must not forget that engineering skill has not reached its limit yet. Power today is carried over distances that a quarter of a century ago would have seemed unbelievable.



Sir Charles A. Parsons, K.C.B., P.R.S., noted British scientist and father of the steem turbins, who declares the world's heat and power problems could be solved forever by sinking a 12-mile shaft and tapping the tremendous heat of the earth's interior

Charles quietly experimented, until now he has been able to announce that it is thoroughly practicable from an engineering point of view, and that the only bar to beginning work immediately is the money necessary to finance the project --- \$100.000,000.

Surrounded by a group of famous

New Masks for Peacetime Uses

Strange windowed helmets cut down casualties in industry, shielding workers' faces from glare, heat, and fumes



out face should such as the The will a work to be made a long contain colored goes woodwar



Old Mississippi Boat Now a Power House

THE fighting heart of this old Mississippl steambout—her engine—had valuable life in it after her worn body, aged by 30 strenuous years, no longer could battle the great stream.

So her owners, the Standard Oil Co., of Louisians, put her on stills in the water

near the bank. There her engine supplies power and heat for one of the company's bunkerage offices. Two firemen, each of whom is called "Captain," constitute her crew. Passing craft salute her with their strens, and the crippled but game old veteran always sounds a throsty answer

Double-Barrel Shotgun Fired like Pistol

WHAT is claimed to be the smallest 20-gage shotgun in the country is shown here in the hands of Arthur J MacDowell, of Philadelphia, Pa., who is the designer of this odd-shaped weapon.

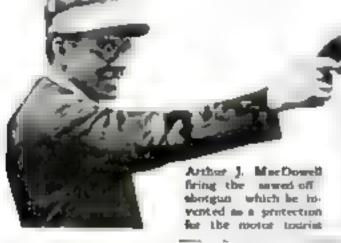
The gun is a double-barreled one, measuring 16 % inches over all. It shoots the regulation 20-gage shells for field shooting or clay target competition. Loaded with buckshot it is said to be

deadly at from 40 to 50 yards.

Mr. MacDowell, who is secretary of the Pennsylvania Railroad Gun Club

and is considered one of Philadelphia's best true shots, says he designed the gun primarily to be of use to motorate touring in lonely, out-of-the-way sections of the country

It will take a nervy highwayman to look this double-barreled pustol in the mussle without making for cover or sticking up his hands.



Ontario Trapper Drives Team of Wolves

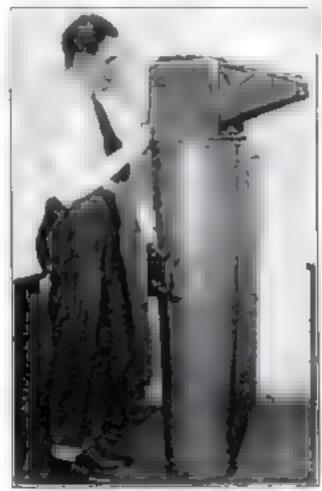
A TRAPPER of northern Ontario, Canada, Joe LaFlamme, recently succeeded in what is east to be the first attempt to tame and harness a team of timber wolves. He obtained the two wolves while they were young, raised them carefully, and finally tried them out,

at first securely muscled. After several trials he removed the muzzles, and the wolves, sensing freedom, bit flercely at the harness in order to break away. But LaFlamme, anticipating this, had substituted chains for leather, and after ineffectual biting, they submitted.

Invents Glant Camera for Long-Distance Photos

MANY times ground rules prevent camera men from getting pictures of the slide to second base, or the touchdown, which is the most thrilling play of the whole game. M. S. Walker, photographer for a big New York newspaper, was disappointed a few times, then made for himself a giant camera which, he says, will snap objects 300 feet away.

Measuring five feet long, this monster, which is said to be the largest practical



Long-distance enters and its inventor

newspaper camera in the world, weight 100 pounds, despite the fact that it is made of auminum

The lens, the secret of the camera's power for bringing subjects at long distances up to the equivalent of 20 feet for smaller cameras, was manufactured in Germany. It is a copy of lenses used by German airmen during the war, long kept secret by them from the rest of the world.

It takes two men to manipulate the camera, which rests on a tripod made like a battleship's gun pivot and is capable of being revolved or moved up and down as necessity demands

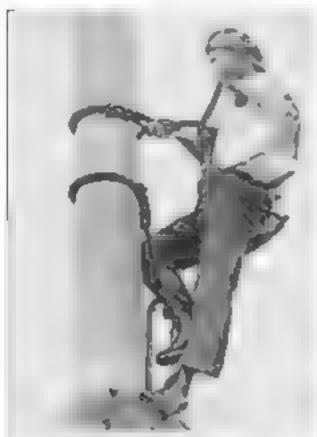


Joe LaFlamme, trapper driving his team of real timber wolves across the sanw in the wilds of northern Outario

One-Arm Steeplejack Hangs on with His Teeth

CLINGING to spires and flagpoles high in the air is a job that takes more than ordinary courage at best, but Henry Wornsing, a steeplejack in Baltimore, Md., does it with only one arm.

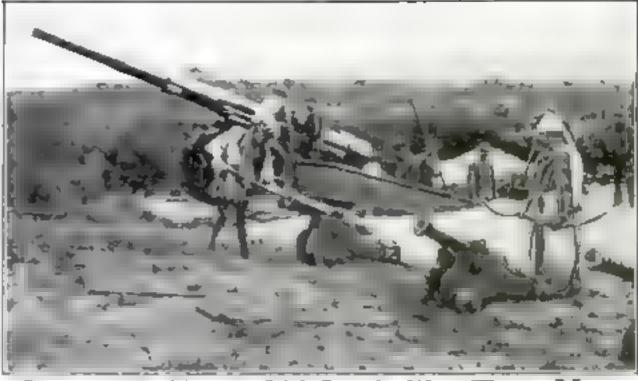
When blood poisoning set in his left arm, necessitating its amputation, he wouldn't change his job, but went on filing his contracts. His right arm seems to have developed the strength of the missing member and with the aid of his strong teeth and jaws, Wernsing keeps on climbing.



The nor went steeplepick at work

Light Colors Aid Growth

YOUNG animals, and presumably children as well, grow more rapidly in rooms with walls painted in light, cheerful colors than they do in dark-painted apartments. Such is the conclusion of Dr. H. A. Gardner, of the research laboratory of the Paint Manufacturers' Association, as the result of recent experiments with guines pigs. His experiments showed that pale blue, white, and light tan were most conducive to rapid growth.



Guns 400 Years Old Look like Toys Now

THE past and present were put into startling contrast recently at Fort Hancock, New York, when Frank Lloyd, a motion-picture producer, set out three old-fashioned Spanish, English, and Corsair cannons of the sixteenth century

When placed alongside some of the

modern engines of warfare they looked like odd little toy cannon. The photograph shows a modern field piece and these old cannon side by side, the latter being muzzle-loaded by a boy dressed in the style of the period when these cannon were in vogue.

Rome to Have the World's Tallest Skyscraper

ITALY soon will have the taltest skyacraper in the world—more than 300
feet talter than the Woolworth Building
in New York City—if a recently reported
decision of Premier Mussolini is carried
into effect. The huge structure will be
built on plans drawn by the noted ItaloArgentine architect, Mario Palanti, who
already has erected several colonial
buildings in Buenon Aires.

Palanti proposes to erect in Rome a structure with 88 floors, 1100 feet high, with a frontage of 1000 feet. It would contain 4500 rooms, 100 large halls, a huge theater, a gymnasium for the training of Olympic athletes, and a concert half. It would be the Roman community center. The general plan is in the form of a pyramid, with a massive base harrowing to a high central tower.

The Woolworth Building, at present the tallest in the world, has 51 stories and

is 792 feet high.



Cricket Umpire Carries a Vest Full of Watches

CRICKET is a popular sport in Engliand. Carrying a watch is a necessity. But the two don't mix. Therefore, P. A. Green, a well known Lewisham cricket umpire, solved the difficulty and added to his popularity by having a special vest tailored with as many watch pockets as possible, as shown in the photograph. He calls it a "cricket waist-cost," and he can easily take charge of a dozen timepieces for the players whose games he umpires.

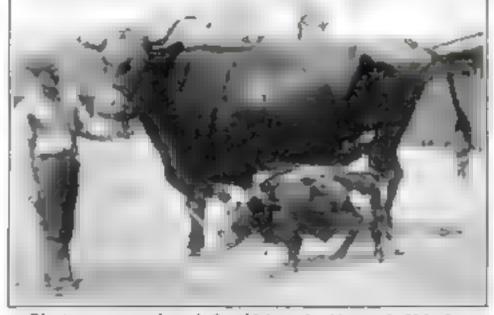
New Gasoline Substitutes

Two new substitutes for gasoline recently have been developed by French chemista. In one, the composition is lignite coke and water, while the other is made from animal and vegetable fats heated with chloride of magnesium or sodium. The process is said to be simple.

The World's Largest and Smallest Steers

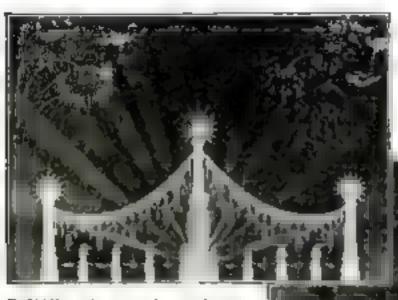
W HAT are said to be the world's largest and smallest adult bovines met recently, and were photographed together

The giant is reputed to be the world's largest steer. He is a full-blooded Texas longborn, weighs 4200 pounds, and is six feet four inches high. The midget comes from a dairy strain and is only 24 inches high



Clant steer more than six feet high, and midget only it inches

Scientific Lighting Creates Spectacular Color Displays



THESE two densing map distracers glutening with germs of many rotions were produced at recent state expenditions by means of g ant search ghts playing hear beings upon thousands of pointed jewels. The display at the left was created at Brackton, Mass., the one below at Syracus, N. Y.

THE science of producing appetacular lighting effects attracted record crowds to two large Eastern exposit one this year—the State Fair at Syracuse, N. Y., and the Agricultural Fair at Brockton, Mass. Features of each exposition were massive columns studded with

jewels and adorned with festoons, colored smoke, and electrical fireworks, all painted in varying and beautiful colors by batteries of giant searchlights using nearly a quarter of a billion candlepower in each instance of this modern decoration. Thirty thousand hand-cut jewels were used. Attached to each jewel was a mirror, so that when the enormous searchlights played on these towers of colored crystal, the effect was most striking

At the Syracuse Fair a mammath artificial limestone cavern was built in front of the grandstand, having a length of 157 feet and a height of 90 feet at its highest point. The stalagmites that rise from the floors of such caves like enormous icicles were duplicated in great piles of jewels, the center one being 90 feet tall. All were covered with additional thousands of gens. Steam issued from their tops and colored lights played through this.

At the Brockton Fair was a jewel display 120 feet wide and 75 feet high, consisting of three large pillars crowned with sunbursts and fringes of jewels, aupplemented by illuminated steam urns.

So that the thousands of people might hear a lecture on "Light and Color," by W. D. Ryan, director of the General Electric Company's illuminating engineering laboratory, a new type of hornless loudspeaker was used. This loudspeaker is said to be able to project the voice clearly for a quarter of a mile in any direction.

Windows Facing South Get Most of the Sunlight

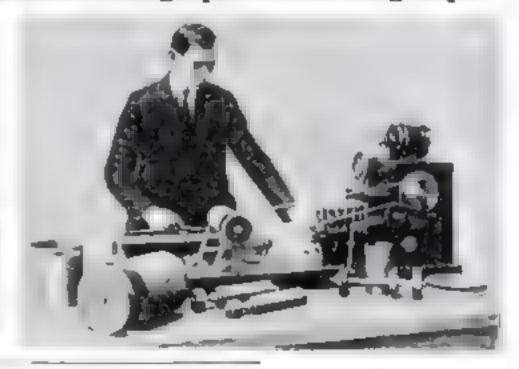
A WINDOW on the south side of a building will get, in the course of a year, 45 times the amount of sunlight that a window on the north side will receive, according to exhaustive experiments recently conducted by William Kunerth, sesociate professor of physics at lowe State College, Ames, Is.

Mr Kunerth's experiment does not include daylight, only sunlight. While the north window is getting one unit of suncime to 45 for the south window, the east window receives 27 units, and the southeast window gets 38 units, according to Mr. Kunersh's calculations.

When the sunshine strikes a windowglass at too sharp an angle, the sunshine is reflected and hence does not penetrate the room, to make it warmer.

New Camera Photographs Revolving Pipe

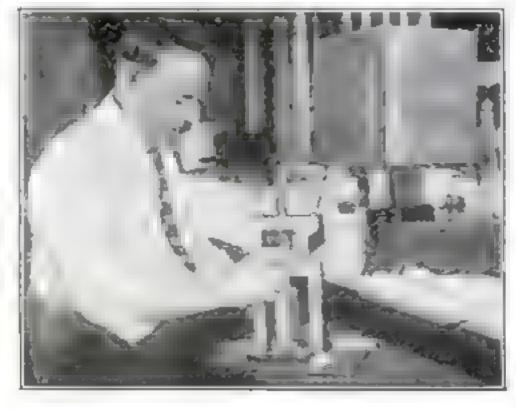
NEWLY Invented camera makes it possible to photograph the entire outer surface of a sample of pipe that has been exposed to corrouen under ground. The pipe sa rotated on a cylinder that in synchronized with the camera so that the film moves automatically at the same rate. The photograph shows the entire pipe's circumference.



The Nation's Candy Tested in Laboratory

TO MAKE sure that the candy we eat is not injurious and that it complies with the pure food laws, hundreds of samples are tested every day in Uncle Sam's laboratory at Washington, D. C

Mr. J. Hamilton, known as the "candy man" of the U. S. Bureau of Chemistry, is shown at the right analyzing samples from hoxen of candy that have been received from the factories.



Molasses Used as Fertilizer in Sugar Fields

MOLASSES is being used with remarkable results as a fertilizer for sugarcane fields on the British island of Mauritius in the Indian Ocean. Increases in yield of about nine tons an acre are recorded after molasses applications. The Colonial Department of Agriculture has made a close study of the experiments and has arrived at a tentative explanation.

When first applied, the molasses partly sterilizes the soil. The nitrification of the soil is suspended and intrates already in the soil disappear

When the effects of the molasses treatment wear off, natrification is resumed at an enhanced rate, and apparently leads to an accumulation of natrates at a time when they can be utuized best by the growing plant.

Ammonia and nitrates are said to have a marked tendency to revert to insoluble forms in the soil of the island.

Air Bubbles Employed to Form Breakwater

A NEW type of breakwater consisting of nothing more than air bubbles recently was devised for quieting even the highest waves of the sea. It is the invention of Philip Brasher, an American. One of the units is said to have been operated successfully at El Segundo, Calif., to protect a concrete pier

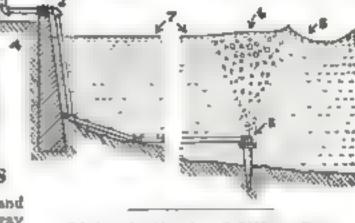
The air breakwater consists of a perforated pipe that is laid along the sea bottom and connected with a land aircompressing station. In rough weather it is merely necessary to allow the compressed air to escape from the holes in the pipe, the air bubbles quickly rising to the surface. The wall of bubbles is said to break up the waves and retard their forward motion. When the water from a broken wave flows back to form a base for the next incoming wave, it finds no support and the next wave curts over and breaks.

The repetition of this process is said to result in a smooth surface beyond the pipe line, no matter how rough the weather. A simple installation of the pipe system, the inventor says, is sufficient to provide a harbor of smooth water in exposed points around coasts that have caused trouble in the past.

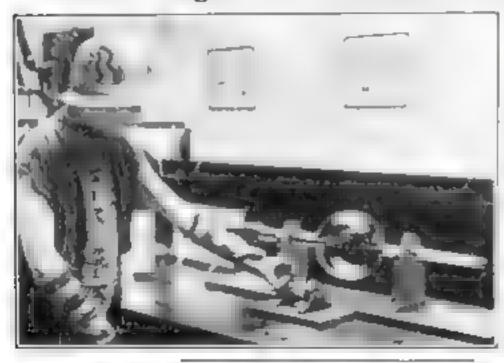


The picture and d agram show how rung air bubbles are employed to break are wores. From an air com-

prisons (1) the oir pames through a supply line 3 to a submerged perfectivel jupe 3. Ascending and expanding oir bubbles form a barrier 6 to the rough water 5 creating a calm area. 7) and protecting the pres (4)



World's Largest and Smallest X-Ray Tubes



THE largest and smallest X-ray tubes recently were placed on exhibition at the National Academy of Science in Washington, D. C. The largest is the most powerful tube ever developed, with 15 times the output of ordinary tubes. The small one is known as an oil Immersed dental tube and has a capacity equal to the standard dentai tube.

Ship Sails in Milky Sea off Coast of Peru

PLOWING for miles through a milewhite sea was the unusual experience recently of the steamship Transolite off the coast of Peru, as reported by Capt. A. G. Cameron to the Hydrographic Office of the U. S. Navy Department

This unusual phenomenon occurred at might and, according to the Hydrographic Other is accounted for by the presence in the water of myriads of tiny plants

In the account of the voyages of the famous scientific slup Chatlenger II a reference to a similar experience, when the vessel "passed through water full of minute alge gleaming like particles of mica."

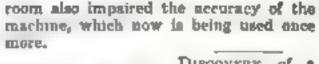
Millionth-Inch "Ghosts" Spoil Accuracy of Wonderful Machine

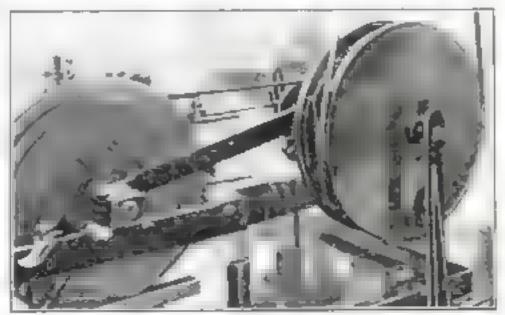
AFTER seven years of futile scientific investigation it was discovered recently that "ghosts" of a millionth of an inch in thickness were the cause of maccuracies in Rowland's ruling machine at Johns Hopkins University

This finely precisioned machine is one of the most wonderful in the world. It is used for ruling lines 1/30,000 of an inch apart on a metal grating by means of a diamond point. The gratings are used in place of prisms for accurate spectrum analysis.

The "ghosts" were found to be spurious lines in the sun's spectrum, which is the band of color produced when a ray of sunlight passes through a glass prism or a grating.

The "ghosts" in the spectrum were in reality only the shadows of other lines. They made the user of the machine see things that didn't exist. It was found that periodic vibrations of a millionth of an inch were enough to produce them and the heat of a human body in the same





Discovere of a successful method of chiminating the pain of childbirth without interfering with labor in claimed by Drs. Regina, Perlis, and Glebat of Paris, France.

The new treatment consists of an injection of a drug and to produce a pleasant sleep lasting from three to five bours, after the manner of "twilight sleep."



Relay System of Pumps Subdues Forest Fires

WHEN the Canadian province of British Columbia was subjected last summer to a continual occurrence of forest fires until over 1000 had been reported, the Parks Commissioner, James B. Harkin, devised a system of water pumps operated in relays that, more than any other agency, assisted the fire-fighters in checking the fiames. So successful is the system that the apparatus has been adopted by the entire forestry service, by the railways running through the wooded country, and by lumber companies.

The system comprises a series of rotary pumps, each driven by a gas engine connected directly with the pump and mounted on an aluminum base. The engine is a two-cylinder type with an energy output of from four to five horse-power and equipped with a magneto. Each unit has sufficient power to draw a supply of water through 1500 feet of 14 meh hose and to lift it to an elevation of 85 feet with a discharge of 25 gallons a minute. The whole outfit weight only 360 nounds.

Science should find a way to make wood and corn busks palatable, and so safeguard against possible future food shortage, according to the statement of Dr Fritz Haber, of Berlin, Germany.

"Dressing-Chair" for Men Aids Neatness and Speed

THE alarm-clock fails to go off and you wake just 20 minutes before you are due at the office. It is then that you appreciate the work of the designer who has patented a dressing-chair for men, in which there is a proper place for every article of a man's clothing

It looks like an ordinary char, but in its back it can hold a man's coat and shirt without wrinkling them. Trousers are passess at the swinging roller just bear passess at the swinging roller just bear the sidesheaves beneath the seat. Trave is a handy adjustable footrest, which is pulled out in front, in which there are compartments for a chochrush and whisk-liroum.

Your collar, tie, and other small articles find a place in a drawer under the chair seat. This drawer is used for pajamas in the daytime,

A man may undress completely and place every article of his clothing in its proper place without rising from the chair it costs little more than a plain, straight-backed chair, in spite of its very ingenious design



The footrest holds the shoebrushes

Removable Hairbrush Is Easily Cleaned

IN CLEANING a hairbrush, usually it is difficult to reach the bottom of the bristles without discoloring handle and back. Here is a brush the bristles of which are set on a detachable pad, which can be slipped out of the back and sterilized in boiling water, if desired.

An additional feature of the brash is the rounded ends of the bristles, which are said to be especially southing and stimulating to the scalp. The bristles are set in pads in several degrees of flexibility.



Bristies siide off brush back

Coyote Becomes a Menace to Northwestern Farmers

AMONG the predatory wild animals that the Washington State Department of Agriculture is striving to destroy, or at least control, the cuyote offers the most serious problem. Notwithstanding a ceaseless campaign against this wily marauder of farm poultry, small pigs, and lambs, as well as countless numbers of game birds, the coyote is increasing and extending his hunting grounds closer and closer to human settlements.

Within the city limits of Seattle, Judge John B. Wright recently clubbed a coyote to death on the road to his court. Coyotes have migrated into the vicinity of Bellingham, Everett, and Aberdeen, localities where their melancholy yadeling had never before been heard. The total damage from the pilfering of these night raiders is said to be enormous.

State Predatory Inspector, Glenn H Bach, is just now investigating the causes of the rapid spread of the coyote pest. First, he says, is a plentiful food supply; second, the excellent cover provided for the rapid breeding of the wild dogs by the thickly growing cedar, fir, and hemlock covering the hills of the Northwest; third, few state and federal hunters in the Northwestern states

Next to injurious insects and plant diseases, the coyote is the worst post now confronting farmers of the Northwest.

Giving the Iceman a Free Hand to Work With

BY COMBINING both handles of an ice-tongs in one, this new tool is easily opened or closed, and can be operated with one hand, according to the designer. It does away with the necessity of opening the tongs before preparing to lift an object.

The tongs is made of alloy steel, well tempered, and may be used not only for bandling ice, but also for lifting and lowering boxes, nail kegs, or any hard and

heavy article.



Ice-tongs bandle is made in one place

ELEVEN varieties of chestnuts secured from China are now under cultivation by the U.S. Department of Agriculture. It is hoped to secure from these at least one type that will resist the blight that has ruined so much of the United States' chestnut crop. The trees are yet in the seedling stage.

Among them is one which, in Yunean, produces note nearly twice the size of the common American variety. This tree is described as suitable for orchard culture. It grows wild at an altitude of about

8000 feet.

rugated paper.

New Spring Will Renew Old Upholstered Chairs

UPHOLSTERED chairs, ready for the junkman because of their sunken seats, may be renovated by attaching a new and inexpensive spring brace introduced recently. It is put on from underneath without disturbing the upholstering, as shown in the illustration at the right, and is said to make the spring seat as plump and firm as ever it was.

Chos are used to fasten the coils to the sides of the chair. If the sent is sagging extremely, it is better, before attaching the spring, to put a little cotton or folded cloth under the sent and, over this filling, place a layer or two of cardboard or cor-

Spring inserted without remeting upholstery



Motor ont-up, showing power lines running from the farm, for threshing by electricity

Threshing Grain by Motor Saves Time and Labor

THE first instance of threshing grain by electricity was on the farm of Eugene Funk near Shirley, Ill., and is said to be a great success. A 40-horsepower electric motor is substituted for the usual tractor for running the separator. The motor is mounted on a truck, and power lines are run from the farm

The first day the electric motor turned out 138 bushels an hour at a current cost of \$2 an hour. The installation, including motor, transformer, switch, master wires, meter, etc., cost \$1200, about one third that of the traction engine, and half the price of a high-powered gasoline tractor, that is frequently used on farms

The man in charge of the apparatur also operates the motor, thus saving the price of a driver

It is said the daily cost of operation, minus labor, is about the same as that for engine or tractor, but danger from fire is lessened and the trouble of hauling [us] and water is entirely done away with, thus releasing men for other work



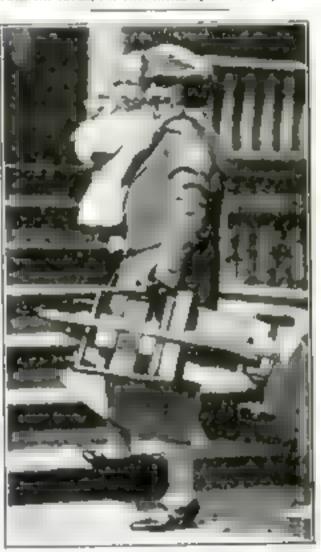
One Movement Opens This Folding Baby-Carriage

SMALL size, light weight, case of folding, and general convenience are the features claimed by the makers for this collapsible baby carrier, which rolls along on three wheels or may be folded quickly and carried under the arm.

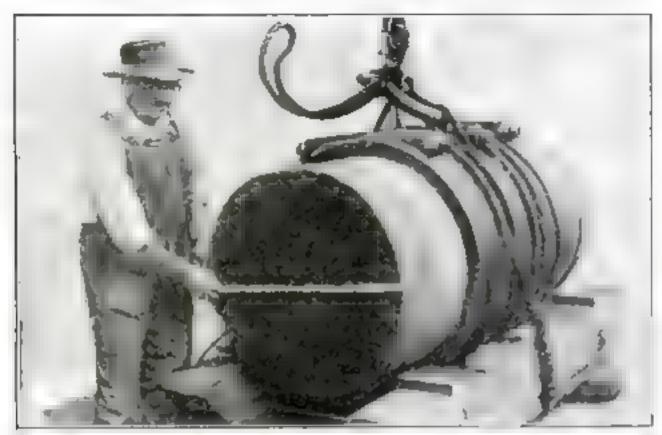
The carriage is made of light, tough wood and the wheels are equipped with rubber tires so that it may be used indoors without injury to the floors of a house. It turns in its own length and has a canvas seat resembling a hammock, which affords the child comfortable and easy riding. The weight of this new car is only 6% pounds and one operation folds or opens it.

For those living in apartment houses in large cities, where there is no convenience for haby carriages, this folding car

is a boon.



Bridge Cable Has 186,666 Strands



'HIS six-foot section of wire cable is a sample of that to be used in constructing the huge Delaware bridge running from Philadelphia to Camden, N. J. The cable is composed of 186 666 strands of wire bound with steel clamps and

measures about three feet in diameter Each foot of the cable weighs several hundred pounds. A power derrick was required to move this six-foot section

when it was placed on exhibition at the Philadelphia City Hall.

Small Heater for Shower **Bath Saves Fuel**

BECAUSE of the great scarcity of coal in Germany, hot water has become a luxury. Romes and apartment houses generally have a "hot-water day" once a week for bathing purposes.

In order to make this operation as

economical as posnible, a German concern is marketing an individual shower heater which is said to supply a sufficient quantity of hot water for a bath from a very small amount of coal in comparatively ahort time.

Tale heater con-Pista of a small special firebox built directly underneath a small water boiler. To this is attached a shower spray and faucet. It is portable and easy to wee it is claumed



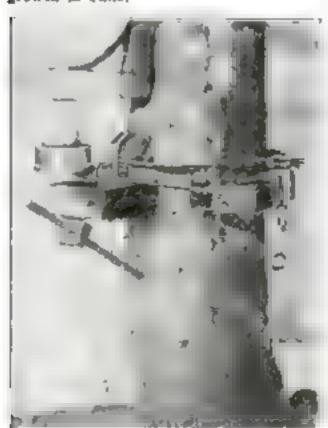
Individual heater for the shower bath seves time and (set

Daily Growth of Trees Now Recorded on Chart

NEW instrument, known as a "dendrograph," makes it possible to measure the growth of a tree from day to day. It is adjusted so that it encircles the tree trunk. Expansion of the tree's girth, as well as contraction due to cold weather, are registered on a chart.

One of the instruments recently used by the U.S. Forestry Service at Flagstaff, Aris., in experiments on Western yellow pine showed no growth on a large tree during 16 days of May, while a small tree recorded growth after the second day During the summer the large tree showed growth on 88 days, and the smaller on 117.

It was shown that pine has its greatest growth in June.



Apparents for measuring a tree's growth

Outdoor Sleeping Robe Replaces Blankets

A CHAMOIS interlined back, a high neckband and a hood cape are feetures of a new sleeping garment designed. not only for use by campers, hunters, and tourists, but for persons who prefer to

sleep outdoors on sleeping porches all the yver around

The loosely fitting robe is worn over the unual night clothes, and in said to take the place of blankets, and to require one third less bed-cov-An extra ern, length of the garment, which extends below the feet, in closed by a draw cord. The hood is detachable

The high neck-

hand and hood cape are said to prevent colds, neuralgia, and similar troubles caused by exposure of the sensitive nerves at the back of the neck and often complained of by outdoor alcepera.



Subarituring for blankers, the electing robe provides warmth

Sawdust "Volcanoes" Become Smoke Pests

bearching for some way to put an end to a "smoke numance" of an unusual kind, resulting from frequent fires in the enormous heaps of sawdust accumulated on old sawmill sites. These fires, which usually are started in spontaneous combustion, send up dense clouds of smoke.

At Leahi Beach in Scattle, Wash., one of these sawdust volcanoes recently renewed its activity after a year of quiet, and its beavy smoke is reported to have driven residents of the district from their homes. City firemen finally subdued the smudge by soaking the crater with water.

In the Washington town of Port Angeles a eswdust pile has smoldered for

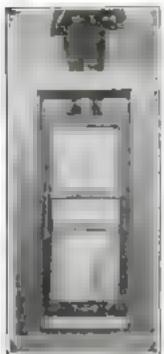
TITIES of the Pacific Northwest are 20 years, now and then bursting forth in flame and billows of black emoke. At Everett, in the heart of the lumber district, a pile of mill refuse covering an area of 10 acres is a source of constant menace. it has been burning within for 10 years. To remove the pile would require a vast amount of money.

> One plan of removal considered by the Seattle city council is the use of hydrau ic machinery to loosen and wash away the piles of sawdust refuse into Elliott Bay. an arm of Puget Sound.

> Thus far no practical use has been found for old sawdust. The few factories requiring this material demand clean, fresh refuse direct from the mills.

Open Windows Locked by Simple Spring Stop

WINDOWS can be left partly open for ventilation at night without fear of the entrance of burglars, it is claimed, by the use of a new automatic window lock consisting of a simple leverand-spring stop that binds the two

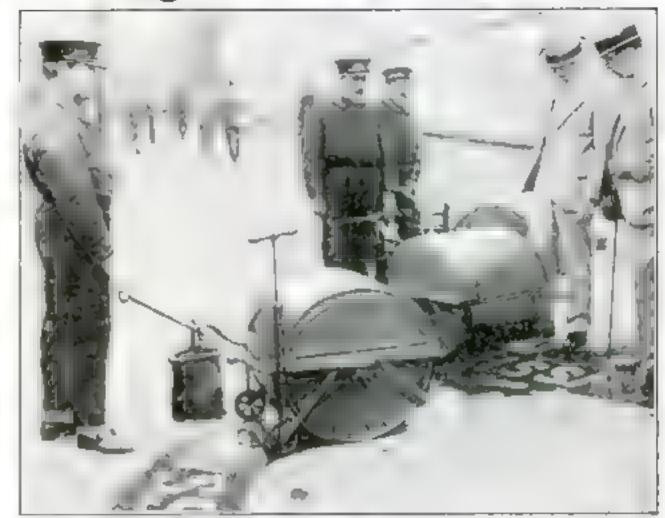


Standing on top of the upper seek to demonstrate the security of the new burgler penof luck

window-sashes together, whatever position they may be in. This it does so securely, it is maimed, that a men can stand on the top such without forcing the locked w ndow down to the sid

The device, [astened with acrews to the top of the lower mah, exerts pressure against the upper wash through a lever tipped with a corrugated face. The lock in released by finger pressure on a catch. The locking device will not dufigure a window, it is claimed.

Printing Sidewalk Advertisements



HE latest advertising scheme comes from France in the form of a sidewalk printing muchine. The photograph shows

two Americans taking a lesson in sidewalk advertising in the Place de la Concorde, Paris, France

The machine consists of a revolving cylinder on which large type has been set to spell out the desired words. The type is 'inked" with a specially prepared paint in the desired colors. The machine then in rolled over the midewalk, leaving an advertising sign displayed.

Pocket Charcoal Heater Warms Cold Hands

ONE of the newest inventions for winter comfort is a small hand warmer consisting of a hollow cylinder

of fiber. A small pencil of heated charcoal is inserted through one end. The device will keep warm, it is

claimed, for a period of two POST IN

To apply the heat to other parts of the body, a wire handle fits into the metal ends and allows the heater to be used as a roller, offering rehef, it is claimed. trom local schen or pains

The warmer is small enough for a man to carry it. in one of last pockets in cold weather



The pocket hand warmer, showing also the charcon i beating unit

Fighting Barnacle Pests with Colored Paints

THE fouling of the bottoms of ships by barrancies may be greatly lessened as the result of recent experiments with bottom paint by the U. S. Bureau of Fisheries. It was discovered that barnacles collect in large numbers only on blue and black plates, and that white, yellow, red, and green plates are practically free from them.



A ship propeller fooled with burnactes

Speedy Water Buses Will Ply the Thames

THE use of the Thames River in Eng- rooms, salons, promenude decks, and land as a town highway soon will be revived after a lapse of 100 years, according to recent reports from London. By next Easter, it is unnounced, a fleet of speedy and luxurious motor boats will be running on regular schedules between Hammersmith in southwest London, and Woolwich in southeast London, a distance by water of about 17 miles. It is expected they will relieve some of the congestion of crowded London thoroughfares.

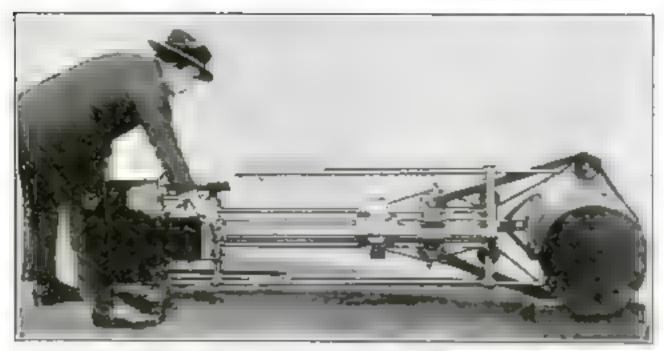
Twenty-five boats will be used, running nt 15-minute intervals. Each boat will be 100 feet long and capable of carrying 300 passengers. The boats will be fitted with luxurious conveniences, including writing-

It is estimated that they restaurants. will be able to make at least nine miles an hour against the tide

Since their draft will be only three feet nine luches, and since the landing places will be built well out into the river, the speedy boats will be able to ply in any state of the tide

Between Hammersmith and Woolwich there will be 25 stations, 12 of which now are ready for use.

NINETERN power projects are possible on the Arkansas River in Cotorado, with a total potential power of 29,000 horsepower for 90 per cent of the time.



Chain Saw Speeds Work of Tree-Cutting

AMAZING cutting speed is claumed for a new chain saw invented in France for cutting trees. The cutting apparatus is in the form of a sprocket chain driven by a gasoline engine.

The sprocket is mounted on a frame. A system of worm gearing forces the apparatus away from the tree being cut as the saw works its way through the wood, thus maintaining an equal tension at all times and insuring smooth operation

The saw is arranged so that it will cut at any angle. The chain, it is claimed, will not get hot or jam when the tree hegins to fall. The deep cut it makes is said to force the tree to fall away from the machine.

In action, the chain travels at about 20 feet a second. A hard oak tree nearly a yard in diameter is said to have been cut through in from two to three minutes by the use of this chain saw.

He Turned His Automobile into a Sleigh

Par He where a 37 the prof.

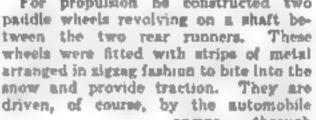
drive that motorused alough

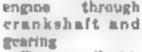
NOT to be denied the joys of sleigh-riding, Albert Horrocks, of Wilton. Me., transformed his small automobile into the ingenious motor-driven sled per-. tured below. In place of the wheels he aubstituted four heavy runners attached to the automobile chassis through springs.

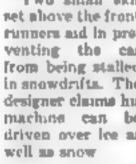
For propulsion he constructed two paddle wheels revolving on a shaft between the two rear runners. These wheels were fitted with strips of metal snow and provide traction. They are driven, of course, by the automobile

genring

Two small skis ret above the front runners and in preventing the car from being stalled in snowdrifts. The designer claums has machina can be driven over ice as







Stenographer Sets Type with New Machine

TYPE-SETTING machine that is operated directly from the keyboard of any standard typewriter has been dengned especially for use in getting out printed form letters and in the production of books. Thus a stenographer, in writing a letter, sets the type amultaneously, Her typewritten page serves as the proof of the type in the form

The setting machine is operated by the typewriter keyboard through electrical connections. It is designed so that it distributes used type automatically an



Setting type with typewriter keyboard

operation that is entirely independent of the type-setting

The first of the machines are being used successfully, it is said, in a letter-duplicating service shop at Dayton, Ohio.

Barriers to Halt Locusts

O STOP the ravages of locusts in the agricultural regions of northern Argentina, 39,000 tons of galvanized steel sheets, valued at \$5,000,000, will be used an burriers.

In front of the sheet-steel barriers the farmers will dig ditches in which, it is expected, the marching locusts will acrumulate and be destroyed.

Gilded Goggles to Save Workers' Eyesight

OGGLES of gilded gases, consisting of yellow glass with a coating of gold, recently have been invented by Dr. A. H. Pfund, associate professor of physics at Johns Hopkins University, to protect the eyes of workmen who are exposed to the intense glare and best from furnaces. The glam is said also to be useful as a safeguard against fire in the handling of motion-picture films.

The gold-coated glass is said to climinate the heat and glare from light, while permitting sufficient illumination for clear vision. The gold passes the light waves on to the eyes, but casts off the heat waves and ultra-violet rays.

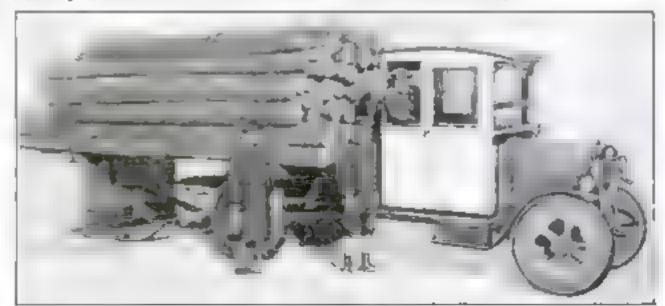
As applied to motion pictures, the invention makes it possible to stop a film that is being run off and to examine an individual picture closely without danger of the film's ratching fire.

Sled Trailer Aids in Winter Log Hauling

THIS easily made sled trailer enables a truck to transport an unusually large and heavy load over winter roads. It was built by a Minnesota lumberman who

refused to allow anow-covered roads to interfere with his hauling.

The truck and sled shown carry a 10-ton load of 70 20-foot logs.



Hanting logs over the snow in Minnesetts with the aid of a sled trailer, which will sarry 10 tens

Three Persons Ride on Tandem Bicycle

GERMAN inventor has come out A with a new form of tandem bicycle that carries an extra person on a platform between the two machines. The contrivance, called a "combi-bicycle," consists of two bucycles attached in parallel, with a platform and seat suspended between them. Thus platform is slung from a light frame connecting the two bicycles.

The pedaling is done by both riders, and the front wheels are connected in tandem so that if the machine is operated by only one driver the steering may be



Tandem bicycle riders with a passenger

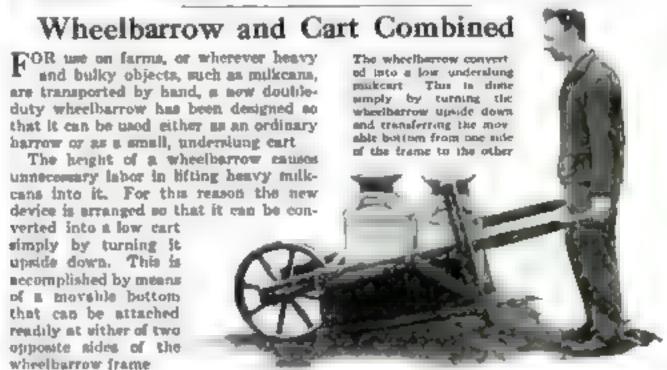
done as if there were only one wheel. This strange contrivance is shown before the famous Brandenburg gate in the city of Berlin.



Highways Repaired by Electric Machines

A NEW type of electric power machine for road-repair work recently has been put to use in France. It is mounted on a two-wheel carriage and pushed like a wheelbarrow. An electric drill bores holes in the road to be broken up, then a forklike arrangement digs away the

Power is obtained either from a portable dynamo or from electric trolley wires.



New Electric "Matches" for the Motorist

TWO new types of "electric match" for the motorist who smokes while he drives, are shown below

One model is detachable, with the lighting instrument on a cord that reels into a container on the car's dashboard The other model is permanently attached to the instrument board or any other part of the car, with an ash receiver

attached below. The beating element is in the center, protected by a movable



Science Learns how Plants Manufacture Sugar

SCIENCE at last has succeeded in making sugar in a way similar to that in which the green leaves of plants have been yielding it for countless ages.

The discovery of the process was made by Dr. E. O O. Baly, senior professor of chemistry in the University of Liverpool, England. In a recent demonstration beform a meeting of the sugar chemistry division of the American Chemical Society, he described the methods by which science can imitate the intricate processes of plants in converting the carbon dioxide from the air and water from the ground into sugars and protoins,

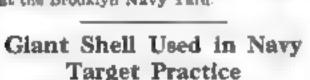
Doctor Baly worked on the theory that the chemical reactions in plants are duato the absorption of quantities of energy from the sun's rays, and that the first reaction is the uniting of carbon dioxide and water to form forma dehyde.

By exposing carbon dioxide and water to the intensely active ultra-violet fight from a quarta-mercury vapor light, he was able to form slight traces of formaldehyde. He discovered, too, that the formaldehyde immediately formed sugar. The reactions, he pointed out, require tremendous amounts of energy.

Last Scrap of a Battleship

T THE right, workmen are shown removing the last remnant of a greatship that never even reached the water-the lest steel beam to be cut from what remained of the battleship South Dakota, scrapped by Uncle Sam. This and a sister ship, the Indiana, now would be the letest addtions to our bettle fleet, if, in the course of construction, they had not. been doomed, in accordance with the Washington Disarmament Conference,

The work of scrapping them was begun November 18, 1923. Two hundred and five working days were necessary to cut both ships to pieces. The work was done at the Brooklyn Navy Yard.



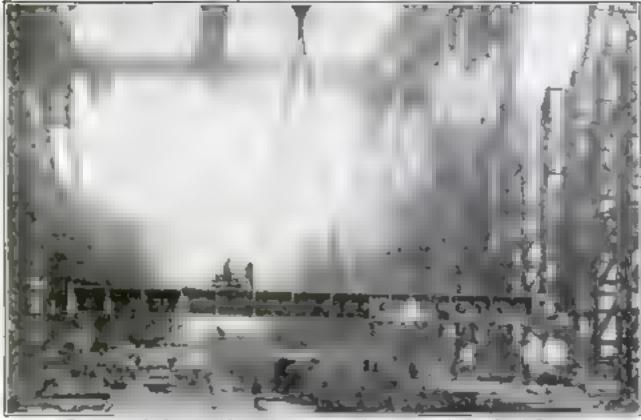
ONE of the giant shells used in target practice by battleships of the U. S. Navy in their maneuvers this fall it shown in the photograph below.

The shell is 14 inches in diameter and weighs several hundred pounds. The big guns can hurl this mass of metal a distance of more than 20 miles.

Jackies are shown in the illustration below with block and tackle, about to stow it away on board the Pennsylvania.



Huge shell used for turget practice



Removing the last sivel beam to accupping the great battleship South Debuts



Odd Four-Seater Driven like a Bicycle

AN ODD foot-power automobile, driven like a bicycle, on the chainand-sprocket principle, recently has been invented by Monsieur Alois Seuter of Neurly, France.

The new machine, which he calls a "Velo" car, sents four people and has a compartment for carrying packages. The designer says he can attain a speed of about five miles an hour with good pedaling. The body is made of light woodwork. The car is steered by means of ordinary bleycle handles.

Tests in Left-Handedness

AS THE result of comparative intelligence tests with right-handed and left-handed individuals in a group of 1019 children, Dr Kate Gorday, a psychologist of Los Angeles, Calif., recently announced she could find no confirmation of the tradition that left-handed persons are of inferior mentality

She concluded, however, that among subnormal individuals there probably is a large percentage of left-handedness. She found, too, that there are more left-handed boys than girls, and that left-handedness runs in families.

Fish Found in Desert

SPECIMENS of fish that swim beneath the manda of the Sahara Desert are among the latest currenties to be exhibited at the American Museum of Natural Bustory, New York City, They were taken from subterranean desert water pools. and are not of rare species, as might have been expected.

One kind is a member of the minnow family. Others resemble perch.

The presence of these fish in the desert remains a

mystery. One theory is that the eggs are transported there in particles of mud or woods carried in the claws of birds that visit the desert water holes.

Wooden Giraffe Formed by Junction of Trees

In THE village of Mussonville, N. H., nature, in one of her playful moods, formed a strikingly realistic reproduction of a giraffe by the junction of two trees that grew together. The dual trunk of one tree formed the lega of the "animal," while the twisted trunk of a second tree, which grew about four feet away, joined the lega and stretched upward like the long neck of a giraffe.

The only artificial work done on it was the chiscling out of the eyes and mouth in order to give the wooden greature a definite expression

This curiosity is located outside the village general store and in the object of much attention from passers-by.



Wooden giruffo e frank of Nature

Bridge Hung from Trees

WHAT is said to be the longest suspension footbridge in the world stretches across the Quinkault River on the Olympic Peniu-Bu.s. Washington. The bridge is 994 feet long and only two feet wide.

The end supports are big fir tress growing on each side of the river. From them the wire cables carrying the bridge walk are atretched These cables are supported also by a center pier 54 feet high, resting on a

mat of rucks and branches. Overhead cables to which the bridge is attached prevent side-sway

The bridge was constructed for the use



of farmers, and is their only means of crossing the river other than by boat, an impracticable task when the spring freshets are running high.

Relics of a Lost Race

VISCOVERY of the remains of an ancient race that once inhabited the lonely Island of Nihom in the South Seam, about 250 miles northwest of Honoully, is reported by members of a recent exploring expedition that went there abnard the U.S.S. Tanuger.

Evidences of human hab tation included acres of garden terraces, home sites, implements, and an infant burial place Many of the

house sites were excavated

Among the relics discovered were apesent bons needles that may have been used for tattooing or sewing, and one odd fishbook made of human bone. Grindstones showing much wear, and polished sharp stone adzes also were unearthed.

Necker Island, 160 miles away from Nihon, showed traces of ancient visitors, but nothing to indicate actual habitation.

Small Propeller Adds New Thrills to Skiing

MOTORIZED skiing is a novel sport recently made possible by means of a small air propelier driven by a light motor that is strapped on the back of the skier. The Invention, from Germany, is said to enable an experienced skier to travel on the level at high speed

The propeller is started and stopped by a pneumatic device similar to that which opens a camera shutter. The motor has one cylinder and resembles an outboard cance motor.



Moster and propeller strapped to skier's buck

World's Champion Tree-Climber at Work



of world's champion tree-climber by formance appears very dangerous. scaling a 100-foot Douglas fir tree, cutting off the top, and returning to the ground -all in 18 minutes.

In scaling a tall tree, Hamilton wears climbing from similar to those used by telephone linemen, with which he gets a foothold on the tree trunk. In addition, he carries a stout rope, one end of which is fastened to his belt. He slings the rope about the trunk and holds the other end with his right hand. By these means he pulls himself upward or lowers himself

During the ascent and descent his saw is tied to one foot to allow him free use of his hands.

To the layman, such a "burnan fly" per-

fact, it is somewhat risky, but the expert climber in a logging crew enjoys the thrill.

ties to me front to leave but hands feet

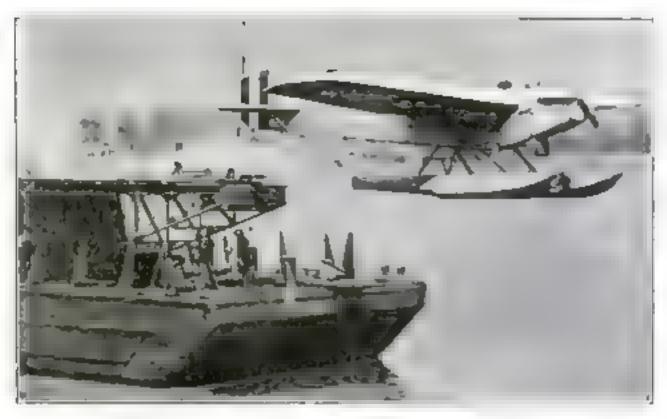
MADE A

descending a setting on

Fir trees, such as those shown in the photographs, form the basis of the lumber trade of the Pacific Northwest. Much of this lumber passes through Seattle and Portland.

Highest Telephone in U. S.

THE highest telephone in the United States is located on the summit of Pike's Peak, in Colorado—an altitude of 14,110 feet, or nearly three miles. It is on the property of the Pike's Peak Highway Association.



Planes Now Shot from Ships by Gunpowder

SHOOTING sirplanes from a ship into midsir by means of a gunpowder catapult is the newest achievement of the U.S. Navy. Instead of compressed air which is usually used in airplane catapults, gunpowder is employed to give the plane its start.

The new catapult gun contains a piston connected through a series of multiple pulleys with a small wheeled car. This

runs on a track about 50 feet long. When the powder charge is fired, the piston, acting with the pulleys, hurls the car forward at a speed of about 60 miles an hour, thus throwing the airplane into the air at a speed great enough to start it on its flight.

The photograph above shows a navy scaplane taking the air by this method of propulsion.

Transforms Falling Plane into a Parachute

TWO remarkable new inventions that may go a long way toward solving the problem of complete security of flying have been perfected by Captain Lepinte of the Technical Section of the French Military Aviation Service.

One of these is a device by which the fuselage of a plane is automatically transformed into a parachute, if for any reason the machine gets out of control of the

palot and starts to fall.

In the center of the fuselage is a rigid axle. The fuselage itself is constructed in longitudinal sections, foined at the far end of the axle as are the stays of an umbrella. Covering this, the parachute lies in hetween the axle and the longitudinal sections. When the plane is in distress, the pilot simply pulls a lever that detaches the wings and the motor, and the umbrella opens, allowing pilot and passengers to descend slowly to earth unbarmed

The other invention is to assure safety in a forced landing, regardless of the nature of the ground. On each side of the fuselage are two fuses capable of developing gas under extremely high pressure. This gas, under control of the pilot, propels the descending plane shead by a series of explosions downward, thus acting like a spring and making the fall harmless.

Navy Flier Sets New Speed Record for Seaplanes

STREAKING through the air at 197.6 miles an hour, Lieut. George T Cudulby, U. S. N., recently smashed the American seapiane speed record in testa above the Delaware River

Lieutenant Cuddihy's speedy plane is a 500-homepower CR-3 machine that won the Pulitzer Trophy in 1920 as a land plane. Now equipped with portions, it has demonstrated its ability to rise from the water and to cover 212 miles in a little less than 60 seconds. The upper plane of the machine is of brass and forms a radiator.

Another scapiane piloted by Lleut. Rulph A. Ofstie, nearly equaled Cuddiny's record, flying at 190 miles an hour

The world's record is claimed by a British scaplane, at 220 miles an hour

Fighting the Boll Weevil from the Air

The latest weapon to be employed in Texas in
the war on the
holl weevil, arch
for of cotton. Cotton-fields now are
dusted with calcium arsenic
sprayed from a
plane as it sweeps
by just a few feet
above the tope of
the plants.

Similar dusting formerly was done by ground ma-

chines, but several advantages are claimed for the new and more spectacular method,



An airplane dusting Terms cotton-fields with calcium-arsenic apray

Flying "Window Shutter" Built in France



NE of the most unusual of the new developments in airplane construction is a machine shaped like a window shutter. with 21 parrow lifting surfaces or wings sheathed with aluminum. It was designed by M. Toussaint, a French engineer, and constructed at the great flyingfield at Villacoublay. It is driven by a 30-horsepower motor.

chief of which is, perhaps, that the plane can start dusting immediately after rain, the most advantageous time to fight the weevil. Ground machines are forced to wait until the ground has dried.

The rapidity of plane spraying is another advantage. One plane can dust an average of about 200 acres an hour at a cost of about 30 cents an acre.

A third advantage claimed for the new method is the fact that the plane does not touch the plants and so damage them. Ground machines always break off a certain quantity of cotton bolls and squares.

The fourth advantage is probably the most interesting. Spreading the poisonous dust grains by airplane causes them to stick to the plants better, because when these grains are shot through the air at high velocity, they retain a positive charge of electricity from the air. The cotton plant contains a small charge of negative electricity. When the two come is contact, they stick closely because of the attraction of the opposite charges.

Altitude Test Chamber Is Made Safe by Valve

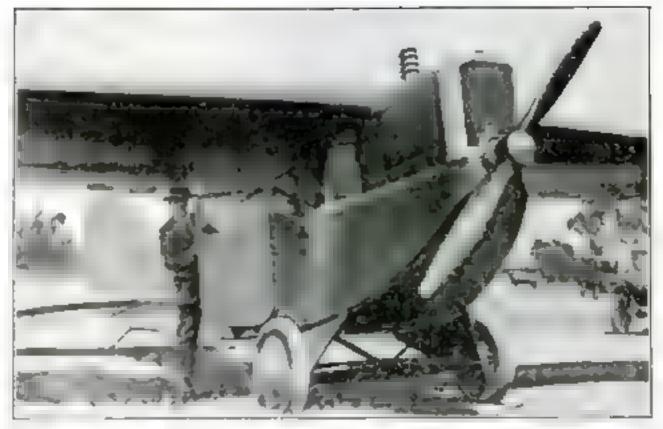
A NEW altitude chamber with a mfetyvalve device has been constructed at the U. S. Bureau of Standards for testing airpance engines in rarefied atmosphere such as is encountered at high altitudes.

An explosion occurred a year ago in the chamber previously used, resulting in the deaths of three men.

To attain the required results the vault must be scaled tightly and the air pumped out. Nobody remains in the chamber when the test is under way, and the air often becomes laden with gasoline vapor that may be set off by a stray spark or backfire from the motor.

The safety valve consists of a rear wall of light material that will be blown out of the back of the building in case of an explosion

This specially constructed wall is made to stand considerable pressure from outside, but will blow out if the pressure include is increased two pounds a square inch. In case of an explosion, this wall will be blown out of the back of the building, where concrete partitions will prevent flames from reaching the operators. By this means it is expected that the tests by the bureau can be continued in entire eafety to the operators.



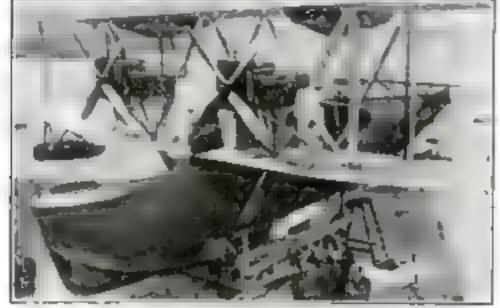
Monoplane Limousine Last Word in Luxury

WHAT is said to be the last word in airplane luxury has just been constructed in the form of a passenger-carrying monoplane built by its designer. Osmund T. Belcher, of Los Angeles, Calif.

The new ship has four inclosed cabins and weighs but 1800 pounds. It is

claimed the craft can earry 107 per cent of its own weight. It is 41 feet wide, 27 feet long, and nine feet high. It can rise 1000 feet a minute, the designer says. Entrance to the comfortable and well upholstered cables is gained easily by means of the door on the side of the body of the machine

This Huge Seaplane Carries 12 Passengers



The new 12-passenger supermerine plane in develock in England

THE Prince of Wales, in naval uniform, is shown here inspecting a new giant supermarine Napier plane, designed to carry 12 passengers. This machine was constructed at the aupermarine aviation works at Southampton, England. An idea of its size may be obtained by comparing it with the men seen in the

photograph.

French Hunter Gets His Shells by Airplane

A WORLD'S record price for shotgun shells was paid recently by a French milionaire sportsman and senator, who had the shells shipped from Paris to Scotland by sirplane. Each shell cost him 20 france, or about \$1.10.

On his hunting trip in Scotland, the senator carried shotguns of a special make, and when he reached his destination he found that he was unable to obtain ammunition for this type of gun. So he hired an airplane and dispatched his secretary to bring him some shells.

The plane left Scotland in the morning and arrived at Le Bourget in the evening. The following morning the secretary bought 1000 shells in Paris and returned

to Scotland that evening.

Oehmichen Sets Record for Helicopter Performances

A WORLD'S record for helicopter lifting flight recently was established at Montbeliard, France, by Etienne Ochmichen, French airman and pioneer in vertical flight, when his machine succeeded in lifting a dead weight of 200 kilograms, or about 440 pounds, to a height of one meter (about a yard). In his first attempt he lifted 100 kilograms, then increased this weight to 175, and finally to 200

By this feat Ochmichen won a prize of 40,000 france for successful performance. It will be recalled that previously he established several records for helicopter flight.

In testa last April Ochmichen flew 575 meters (about 1700 feet) in a straight line, but was later outdistanced by Pescara, who flew 838 meters, the equivalent of about 2700 feet.

The Only Tailless Plane in the World

What is said to be the only surplane in the world without a tail is a novelty recently completed at the French military airdrome at Villacoublay. The unusually large rudder is placed immediately behind the wings of the surplane.

Standing beside the machine is M. Jaugin, famous French airman, who claims the world's speed record as a hydroplane pilot.



This parents tooking plane carries its rudder close to its body



First Diesel Freighter for Great Lakes

FOR transporting coal and ore from the minus of Minnesota to the Ford automobile plants in Michigan, Henry Ford has constructed the first of a fleet of 600-foot Diesel freight boats, which will ply the Great Lakes. The photograph shows the Besson Ford, the first one to be launched, when it was passing through the canal at Soult Ste. Marie, Mich., bound

for the city of Detroit, loaded with coal.

The ship cost \$2,000,000 and is said to be one of the finest and most modern freighters ever built. It is fitted with radio and radio compans.

If the operation of these freight lines proves as successful as expected, it is reported that Ford may branch out into ocean-going trade.

Sixty Upside-Down Sloths Arrive in America

TO BE upside down usually is considered upside down, but with a moth, apade down is right side up. This queer animal is a native of South America. It aves in trees, hanging from the branches by means of its long, curved claws. It never leaves a tree until it has stripped it of every leaf, then it travels over the branches to snother, descending as seldom as possible.

On the ground it is practically helpless, because of its slow and apparently clumsy movements, from which it derives its name. This slowness is due to its disproportioned structure, but most particularly to the fact that its feet turn in awkwardly

Sixty of these creatures recently arrived in San Pedro, Calif. They were captured by Cecil B. Wright, and they constituted the second group of cloths to reach this country in the last 35 years.



The clumsy sloth lives upside down



Historic Palm Tree Moved across a City

THAT a tree is never too old nor too tall to be moved was demonstrated in Los Angeles recently when a large date-palm tree, planted in 1786, was bodily removed from the ground, transferred across the city, and replanted. The reason for preserving the tree in this manner when the plot on which it stood was needed for building was the fact that it is of historical value.

It is estimated that the tree weighs 60,000 pounds. It stands 80 feet high, and two derricks were required to move it. The photo shows the tree being removed from its original site.

Odd Petrified Wood Block Mysteriously Carved

A STRANGE oddity recently discovared in the pine forests of Louislana has everybody guessing, acientists as well as laymen.

It is a piece of petrified wood about two feet square and weighing 103 pounds, carved into an elaborate and intricate series of designs, including at least to the imaginative—flowers, animals and buman faces. There is not a square inch of the surface that is not carved or chased



One scientist who has men it expressed the belief that corpenter ants did the work, but, if they did, it is a unique production, for nothing like it ever before has been found. At first, there was a suppleion that human ingenuity was responsible for the freak, but that theory was abandoned, because of the immense labor involved, and the apparent simileaeness of the energy expended.

The curiosity was found under a fallen tree in LaSalle parish. It is owned by Baker Thomas of New Orleans.

Oldest Stone Buildings Found in Egypt

THE world's oldest stone buildings are reported to have been discovered recently near the famous pyramids of Sakkara, about 16 miles south of Cairo, Egypt. They are two royal temb chapels of the third Egyptian dynasty, about 4000 n.c.

Built in a style differing in almost every respect from what is known as Egyptian architecture, the chapels are believed to have been the burial places of princesses or queens. Fragments of gravestones of royal princesses are reported to have been found near by archeologists who have been digging on the site.

Fluted columns with leaf-form capitals decorate the façades of the chapels, while the side walls have the earliest known form of papyrus capital and column seen in the world's architecture.

Wheeled Parcel Carrier to Ald the Shopper

THE latest European novelty for carrying heavy parcels is a small detachable wheel to which is fitted a collapsible frame. The entire outfit can be carried in

the pocket.

For carrying large bundles homeward, it is necessary merely to attach the wheel to the end of one's walking-stick or unbrella. The result is a small car or framework capable of transporting as much as 50 pounds, according to the inventor, William Helfrisch.



African Bird Enlists Men to Open Beehives

ONE of the cleverest birds in the world is the "honey guide" of Africa, which has learned to entire men to open bechives.

for him.

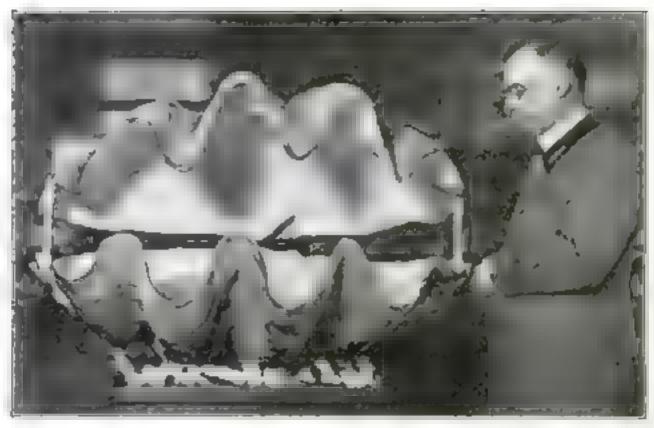
The "honey guide" has a sweet tooth, as well as a liking for the larve of bees, But he is a small bird, and brehives are hard for him to crack. So he seeks out a man, and when he finds one, perches in a near-by tree and begins to chatter. This means that he knows where there is a first-rate have, and that he wants the man to follow him. In the same way he leads his human assistant to the hive, stopping at Intervals to wait for his slower partner to extch up.

These birds are highly valued in Africa. and to kill them is a misdemeanor punishabla by law

New Comet in Western Sky

A COMET that never may have been observed before, recently was distory. It is said to be brighter than any comet that has appeared for several years, being visible through strong field glasses. It is sufficiently well developed to show a faint tail

Apparently the new comet is moving southeast at considerable speed in the western sky shortly after sunset. There is a possibility that it will become visible to the unaided eye.



World's Largest Clam-Shell on Exhibition

'HE world's largest clam-shell, weighing 20 pounds without the mollusk itself, recently was placed on exhibition at the Museum of Natural History, New York City

The giant bivalves, of which the creature that once wore this shell was one. are native to the waters of the Indian

Ocean, the East Indies, and the Philippine Islands They are edible, and their shells are so hard that the natives frequently make az heads of them.

Lying open in cloar water, these crestures are said to present the appearance of a submarine garden of the most vivid blue, yellow, and violet hues.



Giant Wingless Bird Is Reproduced in Model

NE of the exhibits that attracted much attention at the recent British Exhibition at Wembley was a reconstruction of the grant wingless mos bird, which once inhabited New Zealand, but now is

This great creature, which sometimes reached a height of about 12 feet, was unable to fly. It is believed to have existed up to about the middle of the eighteenth century, when it was exterminated by natives. Some of the species were not much larger than turkeys. Their heads were small and the necks almost bare of feathers.

This model was reconstructed from remains found by scientists.

Will Sail around the World in a 68-Foot Boat

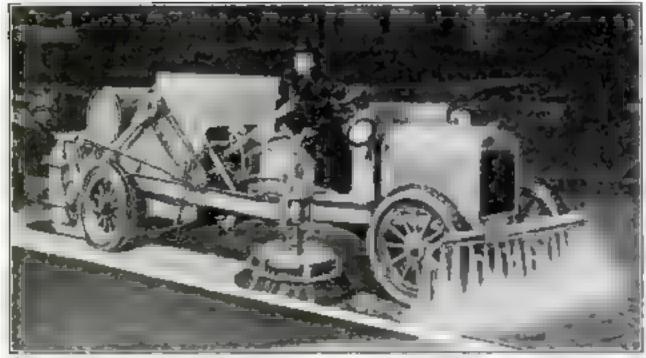
"THE longest cruise in the smallest boat" is the slogan of an aroundthe-world cruise new being undertaken by a party from Chicago, Ill., in a 68-foot all-cypress saining vessel modeled after a Norwegian ketch. The voyage, which is expected to take two years, is under the direction of Capt. A. J. Duken, an experienced explorer and navigator. It was undertaken to obtain moving partures and historical data of little known Islands of the South Soun.

The ship, known as the Big Bill, after | William Rale Thompson, former mayor of Chicago, is the first to sail from Chicago to the Orient by way of the Illinois-Michigan Canal, the Illinois and Musissippl rivers. It is equipped with an auxiliary engine, radio, and many other modern

improvements.



Big Bill ready for two-year world cruise



One-Man Machine Sweeps and Washes Streets

STREET-CLEANING has now come under the eye of science. Herewith is shown a complete street-sweeping and -washing unit that may be operated by one man, the driver of the truck. This mechanical cleaner consists of a street-sweeper, gutter broom, and sprinkling device. It will wash and sweep the street and gutter at one operation, picking up the dirt as it travels.

The gutter broom, made of sectional steel wire, automatically follows the curbline, working in and out with any variations that occur, throwing the refuse from the gutter into the path of the main broom located across the truck at the rear. This deposite the sweepings in the large dust-hopper above. Both brushes are quickly raised when the truck is going to and from its work.



Motor-Meter Light Makes Handy Trouble Lamp

A MOTOR-METER illuminating device (shown at the left) that may be used also for lighting up the motor under the hood when searching for the reason of engine trouble, is easily attached at the base of the motor meter. It consists of a miniature electric lamp wired to the battery of the car.

The bracket allows the lamp to be swung backward for readside investigation of the motor in the darkness. It is the invention of Philip W. Pulig, of Philadelphia.

Trigger Catch Eliminates Rattle of Auto Hood

To completely stop the annoyance of hood rattling, a hood catch has been designed with a trigger handle that extends through the side of the hood and engages a loop connecting two springs that are fastened to the frame of the car loside the hood.

The pressure from the springs pulls the hood downward and toward the inside,



thus holding it firm and saug. The handle is furnished in several finishes.

The device is said to be fastened in place by a light pressure of the hand, and released as easily

THE streets are not the only places in New York City where there is a speed limit. Elevator traffic in the skyscrapers are subject to traffic laws as well. The vertical speed limit is 600 feet a minute. In other words, an express elevator is permitted to travel at the rate of a mile in about seven minutes. If it succeds this speed, an automatic "traffic cop," attached to the running apparatus of the elevator, jerks it to a stop.

Know Your Car

THE proper care and adjustment of the hand brake, which some day may be the only means of preventing a serious accident, is a very important item in the upkeep of a car, yet how many auto owners pay attention to it?

There are several points that may need adjustment or correction Shpping may be caused by oil or grease working out of the axle, by poor adjustment, or by worn lin ings. These faults may be corrected by putting a new washer on the inside of the hub, by washing the grease away with gasoline or kerosene, by readjustment, or by installing a new living.

If the car tends to skid when the hand brake is applied, one wheel is braking more than the other, or one may not be braking at all. The brakes should then be equalized. If the brake is dry and duty, it will squeak. It should be cleaned with gasoline and a stiff brush. Sometimes squeaks are caused by improper clearance of lining and drum.

Odd Streamlined Car Designed for Speed

ONE of the queerest of automotive creations, the body of which resembles the furelage of an airplane, re-

cently appeared in London. The engine, mounted over the rear axle, is only 16 horse-power; but the makers claim the car can attain a speed of 85 miles an hour. A low center of gravity and light body construction make this possible, they assert

Cool air for the motor is drawn in through a tube at the side, while the part of the body that houses the engine is fluted for additional ventilation.

The rear of the

car comes to a point and the front, shown in the illustration, is rounded. This shape of body reduces wind resistance.

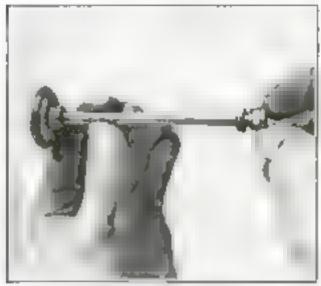


This car, shaped like an airpines (useinge, goes 65 miles an hour

Valve-Stem Adjusters to Increase Car Power

TO DECREASE the noise and increase the power of Ford motors, adjusters may be added to the valventems. These consist of a pair of adjustable nuts that may be adjusted by the aid of two wrenches.

In worn automobile valves the attachments are said to give full lift to the valves. Their attachment is claimed to be very simple.



Applicating note on a trains stem.

Small Car Falls 60 Feet into River and Runs

A REMARKABLE wreck picture was obtained recently when a photographer, taking pictures of accept hear Philadelphia, saw an automobile skid 60 feet over a rock embankment and land in the creek below. The photographer snapped the camera before the driver of the car was able to bring it to a standatill.

The driver is seen making a futile attempt to control the car and steer it out of deep water. He was uninjured, and a

broken radiator was the chief damage suffered by the car.

A some laboratory on wheels, with the necessary professors, recently completed an educational four through several countries in northeastern Ohio. More than 2500 people attended the laboratory classes, many fetching with them samples of sick soil that the professors examined and prescribed for.

Prove "Lean" Spark to Be as Good as a "Fat" One

EXPERTS of the U.S. Bureau of Standards have just disproved another cherished belief of motorists. They have found by exhaustive experiments that a "fat" spark gives no better gration and no more power than a "feun" one

Their mapicions of the correctness of the accepted doctrine were aroused by experiments in Germany where cognist tested with various kinds of sparks failed to show any differences in power developed.

They found that the spark from the feeblest flivver coil was on a par in effectiveness with a spark from the most expensive magneto. THE Editor will be glad to supply, wherever possible, the names and addresses of manufacturers of tools and devices mentioned in this issue of Popular Science Montally

New Adjustable Hose Clamp

MADE of tempered steel springs of cold-rolled steel the positive hose clamp at right can be quickly attached to water-hose connections without the use of tools.

The mamp, according to its manufacturer, is provided with a pawl-and-ratchet device that makes it instantly adjustable merely by moving the pawl to the proper notch. By pressing the lever back, the clamp is tightened instantly. The clamps are manufactured in several sizes.



Covers to Keep Auto Upholstery Clean

BELOW is pictured a new seat cover that is and to be serviceable, easily adjusted, and neat looking, and that any one can install. It is made of rice straw specially treated to render it durable.

Straw cushion covers bound with cloth for the closed car

Hinges between the seat proper and the back rest and the flap in front are made of khaka cloth in order to protect the straw that is edged with two Inches of binding.

The tops of the pads are held in posi-

tion by a strip of cloth that fits over the backs of the car seats. These covers are quickly installed and said to be self adjusting to the seat Their light color gives the interior of the car an attractive appearance, besiden keeping the upholstery in a good condition for s much longer The illustration shows how the covers art placed on the

How Much Do You Know?

WRITE down the answers to the questions below to the lest of your who ty: then turn to page 165 and see how nearly you then to a perfect source

- 1. Why does a Soomerang return?
- 2. What sland effects our growth?
- 3. What is stee ?
- 4 Why doesn't stout persons'
- 5 What is the difference between planets and fixed stars?
- 6. How are the seasons caused?
- 7. What is a crystal?
- 8. Why is it possible that the insole of the earth is growing botter instead of colder?
- What would happen if an irresistable force met an immovable body?
- 10. How do plants differ from animals?
- 11. What rare chemical element is necessary for the growth of textar
- 12. Do electrons really move through a wire when an electric current is flowing?

Radio-the New Paul Revere

Broadcast network to link nation in emergency—Other useful developments and inventions

NE of the most important steps in the development of ratio broadcasting is about to be announced by the Bell System. According to advance information, a vast network of interconnecting telephone lines throughout the country is to be set aside permanently for the purpose of linking broad-

cast stations for events of national importance.

Up to the present, mustiple broadcasting has frequently been arranged. The greatest number of stations hooked up to one studio has been 19, across the northern states. It is understood the arrangement will cover the entire country. This is in accord with the recommendations -Secretary of Commerce Floover at the Third National Radia Conference.

The new network will cut out the tremendous amount of preliminary work niways necessary before the broadcast-

ing of a national event. This invariably has meant taking telephone wires out of service for several days.

The new system will be invaluable in cases of national emergency, when it is necessary to get important information to all of the people in the shortest possible time.

New Light on Static

CONTRARY to previous belief, radio interference from static electricity is bad in the Far North. This is the statement of the Arctic explorer and scientist, Dr. Donald B. MacMulan, who recently returned from a 15 months' expedition into the polar regions. One of the primary objects of his voyage was to study the effects of static on wireless reception

Static was especially bad during the terrific magnetic storms that occur in the north. Some of the disturbances were so

violent as to move the magnetic needle of his recording apparatus like a scribbling pen across the record sheet.

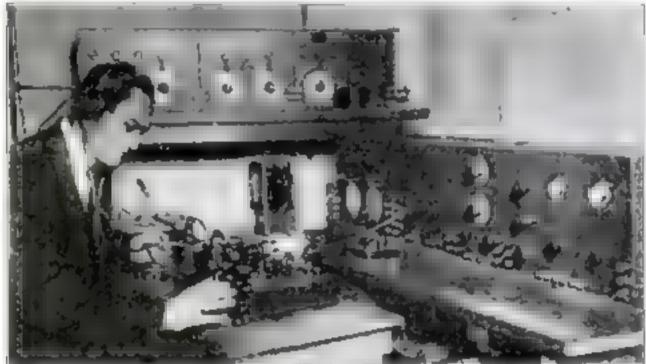
The aurora horealm apparently has no effect on radio transmission, according to Doctor Mac-Milan. When his ship passed through the aurora belt no unusual effect on the signals was observed

During the four months when the Far North was in continuous darkness, the explorer heard

By Jack Binns

America's Most Popular Writer on Radio

clearly the messages of hundreds of amateurs, but as soon as the long hours of daylight arrived, short waves faded rapidly. During the four months of daylight he was cut off from the world.



One of the most remerbable of the new cadio inventions in this automatic redio recorder, which is said to be able to copy signals accurately even when static is three times as great as

the signal strength. The inventor Dr A. Hoyt. Taylor of the U.B. Navy Department claims the mechine con oupy 100 words a minute and that it will revolutional radio-telegraphy

the crew of a train could immediately get in touch with dispatchers in case of any mishap, and traffic could be regulated accordingly.

A second important object is to connect planes if ger a abourd fast express trains with the regular telephone sys-

One of the chief purposes of the tests

has been to find a successful means of

communication to and from moving

trains to supplement the present block

system. With such a system in operation

tent object is to connect passengers aboard fast express treins with the regular telephone system, so that a busiress man in his office could converse with his associate en route between New York and Chicugo, for example. Third, but less important from the railroad point of view, is the arrangement of broadcast concert reception for ранвендега.

The immediate problem is the development of an efficient transmitter for trains. This must be a radio-telephone apparatus of high

efficiency because of the difficulty of petting a good serial on the train. There already exists a system of two-way conversation. Successful transmission over an appreciable distance from a moving train, however, has yet to be developed.

Talk over Power Lines

THE system of "wired wireless" which at one time threatened the supremacy of radio, is rapidly finding its utility in communication work for light and power companies. Recent laboratory work followed by practical application on

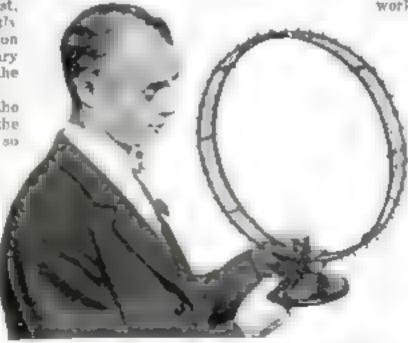
the lines of a power company in Indiana have resulted in important gams in efficiency

Under the new arrangement a metalic circuit is used exclusively in place of the ground connection. Communication is accomplished by placing a carrier of radio frequency on the power line, and modulating it in exactly the same manner as in the usual broadcasting system. The amount of power necessary is comparatively small, for the wave is confined to the line that carries electric power for industrial purposes.

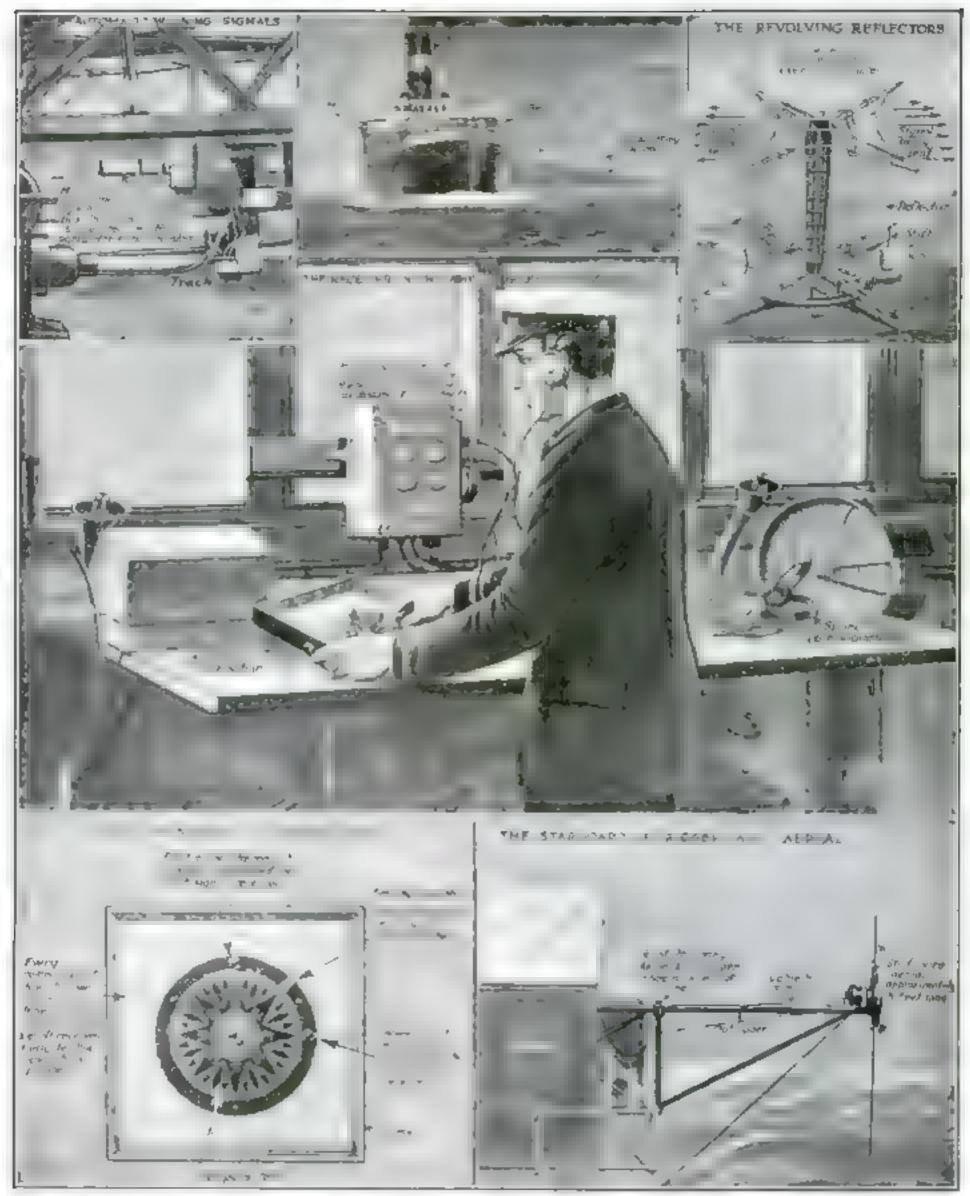
The metallic circuit is obtained by using one wire outward, and a different wire for return. An increased efficiency of 500 per cent is claimed. In cases of emergency, communication can be maintained.

Radio for the Railroads

SEVERAL important radio communication tests abourd fast express trains have been made recently by radioad engineers with improved radio equipment. On the whole, these tests have been successful, but much remains to be done before natisfactory commercial results can be obtained. Among the radioade that made the experiments were the Pennsylvania, Chicago, Milwaukee and St. Paul, Northern Pacific, and Luckawanna.



Although extremely smell, this new loop serial is said to be very efficient due to summal construction and winding, designed to reduce distributed expanity, and prevent losses



The "Radio Lighthouse"—An Amazing New Use for Marconi Beams

IN IMPORTANT new commercial application of Marcans a reflected beam system of short-wave communication is the use of the beams for a radio lighthouse." This new system, perfected by Marcons and C.S. Frankins his assistant, is emplained in the above drawings made by Q. H. Davis from sketches during the first successful experiments in guiding the steamship Royal Scor past the rocky island of luchkeith in the Firth of Forth.

The reflector that sends out the radio beam consists of a series of vertical wires arranged in

perabolic curves. It is retained around the radio transcritter just on the reflecter of a lighthouse to revolved around the lanters. At the base of the reflector are a mamber of Morat signals in ressed metal, each signal corresponding to a given direction on the compant. As these dots and dashes pass a contact but, the transmitter operates and coducts the corresponding again.

In the ship is a company card with pointers attached, called the "bearing corrector." Around this card are Morse signals corresponding to those on the base of the projector. Thus, when the ship a navigator hears a certain signal, he sets one pointer to the point of the compass indicated. Then, when he bears it again he adjusts a second pointer in a similar way. An indicator spaced midway between these points then gives him the currect bearing of the "highthouse". By a fusing device he also can tell how for he is from the lighthouse."

The signals are picked up by stiff wire serials attached to outriggers on each side of the ship.

Confessions of a Radio Gyp

As Made to Newton Burke

How the cheaters "bootleg" tubes, fake condensers, and coils—An inside story filled with hints to protect your purchases

AYBE you've noticed that there aren't as many radio stores as there used to be. Do you know why? It isn't that public interest in radio is dying. Far from it! The number of fams is increasing every day. But the gype—the cheaters who jumped into radio on a "fly-by-night" basis when broadcasting began and reaped a golden harvest for a couple of years selling bad parts and sets for good money—they've begun to quit. They are cleaning up shop.

No, the game isn't played out altogether. There is still plenty of it going on. But it is getting harder every day. The public is getting radio-wise, and besides, the high-class musical-instrument stores and electrical shops have come into the industry with real business methods and are taking the trade away from the gyps fast.

These hig stores have all kinds of facilities for pleasing the public. For example, they have credit backing that enables them to sell the best receiving sets on time. That's why the gyps are dropping out. I closed my store three months ago.

I MUST may, though, that while I was at it, racho was the softest thing I ever tried. When the country, the fans would flock to our stores in draves. They read everything that was printed about radio, and the newspapers had new circuits for them to try

almost every day. They'd come to us looking for the parts specified in the newspaper articles, and we always had them on hand, because we had cheap help making them in a back room—imitations in junk of the parts made by autional manufacturers. Colls would on cardboard tubes, for example, that cost us perhaps 50 cents to make, and sold for six dollars each. Those were the good old days

I remember when there was a run on variocouplers of the 180-degree type. These were made by a young man who had just started in budness for himself. They were wound on bakelite tubes with double silk-covered wire. The two bakelite tubes were held together with an

aluminum frame that permitted the inside coil to be rotated through 190 degrees.

It was a fine coupler, there was a great demand for it, so we copied it. Only, instead of bakelits, we used cardboard painted black, and we took a mold of the aluminum frame and cast it in lead. Thus we were able to "reproduce" the coupler for a few cents.

The original coupler had a list price of \$6.50. We printed the same price on ours. Then we advertised them extenlitigation to be completed; besides, you can generally find some interference claim against any patent; so it's protty easy to infringe for awhile.

Take the regenerative circuits, for example. When radio sets began to sell widely, almost all licensed manufacturers were getting what today would be considered large prices for one-tube regenerative sets, and they couldn't supply half the demand. This furnished a situation that we found made to order

for us. We collected the cheapest parts we could find and hooked them up regenerative style. We always could find some young amateur who would supervise the job and see that it was done correctly. Gut-rate advertising did the rest.

Of R"beautiful mahogany cabinets" were stained pine. Our "genuine bakeine" or "hard rubber" panels were "mud"—cheap powder molded in a form. And the fame who bought these sets thought we were public benefactors because of our prices!

Condensers d do't even cause us the trouble of making them. They were chipped to us by gyp manufacturers, all ready to sell; for, of course, there were almost as many gyp manufacturers as storekeepers. They would copy all the popular models of condensers, using the plate instead of aluminum or brass, and fiber insulation.

Tubes undoubtedly were our best line. In

fact, they were the first thing to be "bootlegged" in radio. The tube hootlegger,
who, of course, was a man who was manufacturing tubes without a license, would
move his plant overnight if the licensed
manufacturers happened to locate it,
and open up in a new place the next
morning. Then some of the big independent manufacturers discovered there was
some uncertainty in the law covering the
tube patent. After that it wasn't necessary for the gyps to move so often, and
they turned out tubes faster than ever.

Tubes were bound to be a profitable line for the gyps, because the licensed manufacturers couldn't come within miles of supplying the early demand. At first (Lantenard on page 112)

Beware the Trickster!

His "solid mahogany" is stained pinc. His "genuine bakelite" and "hard rubber" panels are cheap composition.

His cut-rate tubes are "rebuilt."

His "aluminum" condenser plates are tin. His tuning coils are wound on cardboard.

He sells you "standard" sets and parts that never saw the factory of the manufacturer whose name and trademark they bear.

Here's the inside story of the Radio Gyp and his methods—an exposure of his tricks; vital information that may prevent you from being swindled

It is an article that brings home to us the value of dealing with concerns with established

reputations for honesty and fairness.

As you read this story, remember that you have at your service the Popular Science Institute of Standards. A list of products, tested and approved by its engineers, will be sent you on request.—The Editor.

sively at cut rates, and sold thousands of them at four dollars each. The man who designed the coupler soon went out of business. The big car I'm driving to-day was bought on the profits I made on that deal.

**were our heat line. In fact, they were the first thing to be "boot-legged" in radio. The tube hootlegger, who, of course, was a man who was manufacturing tubes without a license, would manufacturers happened to locate it.

ONE of our best tricks was to make up some piece of junky apparatus, give it an impressive name, put it in a good hox with a pretty wrapper, and then label it "patent pending," or "patent applied for." We'd invariably sell thousands of such articles, whether they had any place in a radio set or not.

And of course the fact that an article was patented never bothered us. It always takes time, you know, for patent

How I Play Radio Doctor

Simple Remedies that Will Keep Your Set out of Trouble

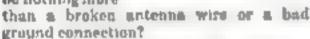
By M. B. Sleeper

F YOU own a radio set, the chances are that you have some "expert" friend who very willingly offers to help you out when anything goes wrong He tells you he has built several radio sets himself and knows all about them.

And the chances are that if you have invited him to dig into your set, you have found that instead of improving it, he has left it worse off than before. Likewise, you have discovered, perhaps, that whenever you yourself try to tinker with your set to make it perform better, you succeed only in eausing yourself all kinds of trouble.

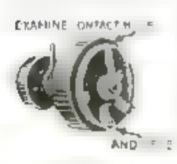
If you had a sore ankle that impeded your walking, you wouldn't let some friend perform

a major operation on your vital organa, would you? Why, then, should you operate on the vital mechantern Inside the calmet of your radio set when the trouble may be nothing more



Yet the fact remains that radio-set owners by the thousands persist in doing the most absurd things in trying to shoot trouble where there is nothing wrong at

THE old adage that "a little knowledge is a dangerous thing" never was more truthfully applied than it is to radio. I have found in my own case, though,



that in a real sense I can play doctor to my racho set nuccessfully without ever touching its delicately constructed and seastive inner mechan-19m. My remedies, when my set isn't

working right, are as simple as bandaging a cut finger. And because they are remedies that the owner of any radio set can apply. I am describing them in this article

The first thing to remember, then, when your set isn't performing just right, is that radio outfits built by reputable concerns are so thoroughly inspected that there is very little likelihood anything will go wrong inside if they are given reasonably good care. In 99 cases out of » hundred, the trouble has outside the set. itself-in the tubes, the batteries, telephones, loudspeaker, untenna or ground.

Whatever the symptoms of trouble are,



"When your set fails to work eight " says Mr Streper wately known sudin engineer chances are 99 out of 100 that the trouble has outside the set itself and can be remedied wishout prying nothin the cabinet sources of trouble are shown in the photograph above and in the small electrics on this page

the best thing to do is to test these points in the order is which I shall give them.

Before anything else, look at your anterms. Make sure it is up. See that the

LUGS OR WIRES MAY BE

ead on 28. braken. Look for a metal object that might have falen on it Examine the antenna binding post on the set for perfect connection

Go over the ground lead in the same way. Frequently it is kicked

off and broken. Perhaps the connection with the water pipe has become corroded. I know of one case where, in changing the plumbing, a pipe was disconnected from the water system so that it served as a ground no longer. If the antenna lead or ground wire is in-

REMEMBER THAT CENTER



maide the insulation. When the tubes fall to light, either the A battery has run down, or the wires have become loose, or the contacts in the filement control jacks do not touch, or the socket contact springs have been bent down so that they do not touch the

pine on the tubes, or

sulated, the wire

may have broken

the tubes have burned out. I the tubes burn diraly, the A bat tery probably is low. Remove all but one tube from the set and see, when the one remaining tube is lighted, if it burns below its normal brittiancy. If so, new dry cells are required or the storage battery must be recharged.

DO NOT test either dry cells or the storage battery by short circusting, to see if there is enough energy to make a good spark. That test tells nothing and runs down the batteries. Every radio-set owner should have a good voltmeter. It must be of 10,000 ohms resistance. Such a meter costs about eight dollars. If you cannot spend that much money, do not get one at all, for the pocket type is worthless in testing radio hatteries. Get a voltmuter to read up to 50 volts. This will serve both for the A and B batteries.

Four dry cells connected in series should read not less thus five volts, or the same value for a

storage battery. The best test on a storage battery, however, is made with a hydrometer. Full directions for its use come with it. It will tell you the exact state of the battery, whether it is fully charged, half charged, or entirely dis-

charged. A hydrometer costs about a dudar and a half. If you are going to Dave guests and want to make sure that there is enough energy in the battery to last through the evening's enter-



SEE IF SPRINGS HAVE DEEN BENT DOWN

tainment, test the battery the day before. Then you will have time enough to charge it if it is dangerously low

THE first test for the B batteries is to put the set in operating condition with the tubes lighted. Then disconnect



the negative ter-DE SURE THAT SPENDES minel of the 1 battery, This ahouldi give strong click in the phones or loud speaker. If it does not, the B but

teries have run down, the jack is not mak ing perfect connections with the telephone plug, there is a loose connection in the plug, a broken lead in the telephone cord or the telephones themselves are defective

These latter points also apply to loud speakers. Test the batteries with you high resistance voltmeter. Each 22-vol unit should read at least 17 volts, or eacl 45-volt unit at least 34 volts. If the

(Continued on page 171)

A-B-C's of Radio Language

If the names of parts in your set puzzle you, you should read this article -Valuable hints for the novice

By Robert E. Martin

NE of the most difficult things to understand about radio is radio language. Many a broadcast fan, I am sure, has been frightened away from learning something more about his receiver than how to set the dials because, when he sought information, he

found himself lost in a make of technical

Yet the language of radio is no more difficult than the language of baseball, or the lartguage of finance, once you have the key. You would scarcely expect a baseball writer to axplain in detail just what a "bose on balle" was every time he had occauton to use the term.

Similarly, the radio writer or the radio engineer in describing a hook-up would find it most inconvenient to say, "you insert here a resistance device connected from the grid of the vacuum tube to the filament to prevent the likelthood of the tube's fashing to function properly through too high voltages collecting on the grid." So he says instead, a "grid leak," which, when you understand its purpose, you admit is an apt and graphic term.

IN OTHER words, the terms of radio. which may seem like a foreign language to you, realiy are used for convenience-yours as well as that of the radio engineer.

These are the real a-b-c's of radio, and to understand radio without knowing what they mean is nuite as impossible as it would be to understand an auto-

mobile without knowing the difference between a spark plug and a carburetor

There are two ways that occur to me of learning the terminology of radio. The first is the obvious way. Get a good radio textbook, go off to a quiet room, and study. That method, however, probably wouldn't be particularly enjoyable. The second method consists of thinking in radio terms as you operate your receiving set. That you can do without in any way interfering with your enjoyment of the broadcasting. Let us see how you can go about it

A few days ago, in the radio laboratory of the Popular Science Institute of Standards, I saw a three-tube set, having a detector and two stages of audio-frequency amplification. If you read my last article, you will recall that this means

A set that not only eaz pick up broad-ANTEHNA AMPLIFYING VACUUM-TUBE VACULM TUBES DEFECTOR AUDIO-FREQUENCY AMPLIETING FRANSFORMERS ANTENNA **GROUND** YARIA BLE الفعصا CONDENSER

Front and year views of one of the simplest - your set as emblined by Mr Martin visc forms of radio receiver with each port accompanied by its name and symbol. If you study the purpose of coch port in

will see how aptly each name is applied. and it will man lose its terror. Three names are the real a-b-c's of radio sesence

easting, but can magnify received signals so that you can bear them better.

Now, imagine you have bought this set, and, with the assistance of some friend who has had experience in radio, have installed it in your home. A and B batteries are connected properly, your acrial is up, and your ground connection has been

On the front of the set—the "panel" are two dials and four little knobs. These are lettered "Antenna Condenser," "Primary Inductance," "Coupler," and three knobs are lettered merely "Fil." Your friend has explained to you how pulling out a little nickeled button connects the batteries with your set. He has told you that you place your telephone plug in the ornitoes marked "Detector," "First Stage," and "Second Stage," depending on how loud you wish the signals to be. He has

told you that the three little knobs lettered "Fil," are not to be turned heyond a pertala point unless you want to buy a new tube to replace one that has been burnt out. Then he has told you that by turning the two dials and the other knob you could tune in broadcasting - probably demonstrating how it was done—and left you to your own resources,

PROBABLY for the first couple of evenugs thereafter you are content merely to turn the knobs in a more or less mechanical way, entistied so long as you hear the broadcasting Then you become curlous, you open the cover of your set and peer in. Outside of the three vacuum tubes, whose use and purposs you probably understand a ready, the most striking piece of apparatus you see hecause it is the largest - is the double coil operated by the dial marked "Coupser." This device is what is called a rariocoupler. Its purpose is to belp you tune your radio set by varying its inductance so that only radio waves of a destred frequency of vibration will be admitted

Inductance means the property causes a coil of wire

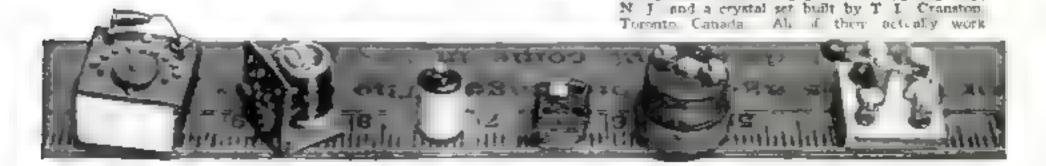
through which an electric current is flowing to become a magnet. Whenever you have a coil of wire connected in a radio set, you have an inductance. If a second coil of wire be placed near the first, the magnetism of the first coil will transfer electrical energy to the second coil by induction, the coils being called respectively the primary coil and the accordery

The two coils need not be in contact; (Continued on page 174)

Who Can Build the Smallest Set?

Amazing Midget Receivers and Parts Displayed at Radio Fairs





How I Get the Most out of Two Tubes

An Unusually Compact Loudspeaker Set You Can Build Cheaply

By H. G. Silbersdorff

VERY so often a new circuit appears. A few odd-looking connections shown in the diagram bite into the curiosity bump that we all have, and before we know it we are lying awake nights wondering how this part can be pleasing results are those that lean toward standard practices in radio-circuit designing. Many tricks have been resorted to to eliminate losses, and when a standard circuit is incorporated into a set in which care has been taken to avoid these losses of electrical energy, the results usually are surprising.

The circuit I am presenting here is that of a two-tube receiver which, according to tests, will give about all that can be expected of two tubes. It is a combination of radio frequency, regeneration, and reflex. It is comparatively simple to construct, takes up little room, is economical in operation, easy to operate, and will afford loudspeaker volume. A large number of the distant stations can be beard with a good degree of consistency.

set can be made up compactly, requiring but a seven-by-12-inch panel and cabinet. This puts it into the semiportable class, so that it can be placed in the tool compartment in the rear

wind the spider-web forms. These can be obtained in any radio-supply store; in fact, even the 5 and 10 cent stores offer complete forms, together with the adjusting arm and knob.

The first form contains both the primary winding, which is untured and consists of 10 turns of wire, and the secondary, which consists of 45 turns of No. 22 wire. The winding of this form is so arranged that the 10-turn primary is located in the center of the secondary winding. That is, start winding the secondary coil, and after making 22 turns. do not cut the wire, but leave the end loose and start winding the primary. When 10 complete turns have been made, leave a lead of about six inches and then continue winding the remaining 28 turns of the secondary. Be sure both windings go in the same direction and wind the wire tightly, otherwise trouble will be experienced in getting the proper number of turns on the form.

THE tickler-coil, which is wound next, consists of about 20 turns of the same size wire. I say about 20 turns because this will vary in some cases. In operation, if trouble is experienced in getting the set to oscillate on the lower waves, it will be necessary to add a few more turns. Using an aerial consisting of a single wire 110 feet long, the set seems to break into samy oscillation on all wave lengths when about 18 turns are used. It is comething for the individual to experiment with

The diagram is self explanatory. The



E G. Stibersdorff, noted New York expert on reflex receivers, with the new loadspeaker art which, he mays, has proved it will give the utmost that can be espected from two tubes without sacrificing quality

made, or how that point can be arranged to get the shortest lands to the tube.

After spending much time and money in experimenting with the so-called new circuit, we come to the conclusion that there really is nothing new about it, and charge the whole Item off to experience.

ONE tube has the ability of giving to just so much selectivity, volume, and distance. Two will give us just so much more of either volume or distance, and the same applies when three are used. Regardless of the circuit, if losses have been considered in the construction of the set, we can hope to get only as much out of one or two tubes as is in those tubes. In other words, we can get only as much out of the tubes as the circuit will permit us

Some circuits are admittedly better than others, and it is noteworthy that the circuits from which we obtain the most

The parts reourred are :

- 1.7 by 12 panel 1.5 by 12 cab net 2 apaiet web forms 1 apader web form
- bracket
- 2 tube sockets
- 1 aga wivequency transformer 10 to 1
- radio-fre-1 from cuce. transferons QUETCY.
- 1 0005-mid. variable
- 6 00025-mid condenser
- with griddean or or bard asem blen 100, I
- Co. Di. COST
- condenser
- I open-circuit, telephone
- jack
- I grid-leak mounting
- 6 hind by 1h. net wire
- Jac k the megobin grid leak I piece haid rubber 14 handing posts by 8 br 2 inches in. No 77 d.c.c. man- 1 basebeard, 81 by 6 inches

I closed-circuit relephone

An assortment of wood screws, bus bar, spaghetti, and soldering iron, also will be

In building the set, the first task is to

one point that varies from the usual practice is the insertion of the tickler coil in the plate of the radio-frequency tube, which gives radio-frequency regeneration. Tests showed that the set had less tendency to squeal and howl when it was inserted at this point, rather than in the plate circuit of the detector tube.

Front view of the penel, showing the remarkable simplicity of operation.

Besides the variable condenses disk the only tuning control is the knob-

at the lower left, which operates the coil controlling regeneration

The circuit will how when the tickler

coil is advanced too far. Preventing this is simply a matter of becoming familiar with the operation of the circuit and noting the best points of advancement for the coil on given wave lengths. As in

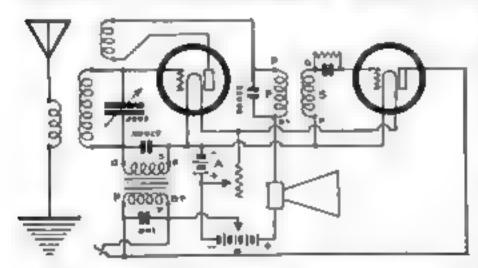
other types of regenerative circuits, when a station is first tuned in, a whistle will be heard as the tuning condenser dual in adjusted. The next operation is to reduce the regenerative action by separating the secondary and tickler coils. When once a station is logged, it always can be obtained at a later time on the same setting

Occasionally, in a set of this type, even with the addition of extra turns on the tickler coil, difficulty is experienced in getting the set to oscillate on the lower wave lengths. If this should be the case, the insertion of a

grid leak with a value of .075 across the primary of the audio transformer will bring the desired results.

As a matter of fact, a leak at the point always is an advantage, for it enables the set to break into easy oscillation over the entire wave-length scale—a thing that is necessary to obtain long-distance reception

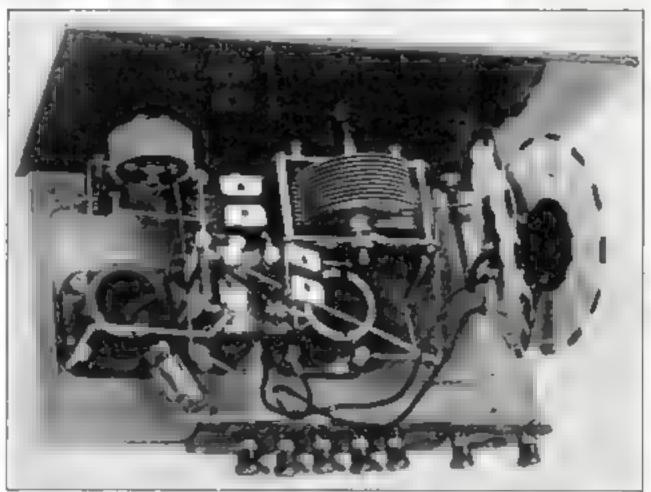
A word about the transformers. Select a radio-frequency transformer made by a nationally known manufacturer. A curve usually can be obtained on a good transformer, and this, it should be noted, must cover the broadcasting range. For reflex circuits such as this a transformer having



Wiring diagram that should be followed closely in building the set

on the audio side, a transformer having a ratio of about 10 to one will give about the best results. A single-circuit telephone tack is connected across the primary of the audio transformer. This enables you to luten in with one stage of radio-frequency and the detector, the phones being connected across this transformer. You can tune in a station accurately while the loudspeaker is still in operation.

The set will operate with any of the standard tubes, although greater volume can be obtained with the UV-201A type. If you use these tubes, which have their filaments connected in parallel, a



Rear view of the two-rate set, showing the compact arrangement and wiring of the parts

20-ohm rheestat must be supplied. The current drawn from the two tubes is only half an ampere, and under this load a reasonable amount of service can be obtained with the use of four dry cells connected in series. Needless to say, because of the steadier current obtained, the ideal thing is the storage battery, which can be of six volts and for service with two tubes about 60 ampere hours

Using the WD-II or WD-I2 types of tubes, three or four dry batteries connected in parallel and a six-ohm rheostat give good results. Usually these tubes will not permit the use of a higher plate voltage than 45, consequently the volume

will not be as great as in the case of tubes for which the voltage can be raised to 90 volts, giving ample volume for the average household on a loudspeaker

A little care in wiring the set will pay.
After wiring many sets
of various type, I have
found that the very
best kind of soldering
flux to use can best be
made at home at slight

It consists of a mixture of one part of

powdered rosin to 10 parts of alcohol. Pure rosin can be obtained in any musical supply store in the block form. A fair sized piece is placed in a piece of cloth forming a bag and crushed to fine powder by pounding it with a hammer on a cement floor. Powdered rosin also can be obtained, but it usually contains much dust and dirt and therefore is not advisable for radio work.

One teaspoon of powder dissolved in 10 parts of alcohol and allowed to stand in a corked bottle overnight makes the ideal soldering liquid. After a joint is once made with this mixture, the alcohol dries quickly from the heat, leaving a clean joint that will cause no troublesome

noises in the set after it has been in use a year or more.

For the most satisfactory results it will be well to follow closely the wiring diagram shown on this page. The rear-view photograph, showing arrangement of parts and wiring, will serve as a guide to aid you in making the connections.

The importance of tight connections cannot be overemphasized; for on them depend the real quality of reception

With a good aerial and ground, I have found that this set gives me everything to the air that I want to hear

Two Sets in One for Long and Short Waves

ONE of the most unusual of the new feats of radio construction is a two-in-one receiver combining on a single panel a three-circuit honeycomb-coil set for long-wave reception, and a neutrodyne set for short-wave reception. The same set of tubes is used for both sets and two different programs can be heard simply by throwing the change-over switches.

The set is nearly and compactly constructed and is said to be very efficient. It was designed by Rutledge R. Mayo of New York City, who is shown below with his matrument.



The two-in-one art and its builder

Longer Life for Dry Cells

How to Make Them Work Overtime-Useful Radio Hints

Also pry off the brass screw connectors.

Wax and screws both may come in handy

IF YOU use the large type of dry-cell vacuum tubes in your set, you probably have wondered often how you might make use of dry cells that you are forced to discard simply because the amperage has dropped below the mini-

mum required to operate the tube. Almost always these cells have a good don't of "juice" left, which it always seems a shame to waste.

You can make use of the remaining current in the following way

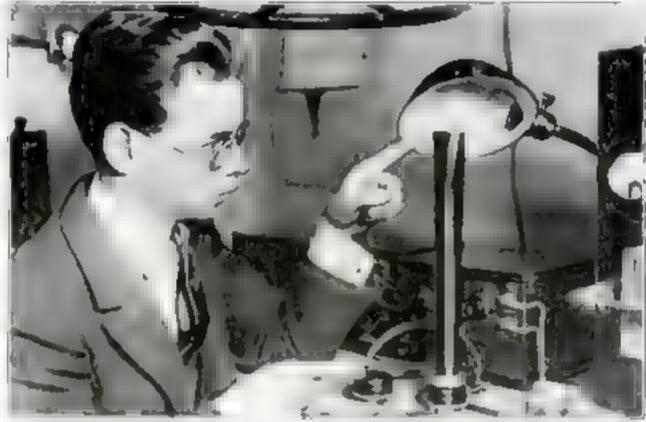
When you get a new set of four dry cells, instead of discarding the worn - out ones, store them away in a cool, dry place. Then in about six or eight weeks, when the new battery seems about ready to dis, connect one of the old cells to make five cells in series.

Immediately you will see your battery take on new life, And

when the five-cell combination gets too weak to work properly, add a sixth from your store of old once; then a seventh and an eighth

Finally when the eight-cell battery gives up, you will feel that you have your full money's worth and will be ready to throw the cells away. Before doing so, however, salvage the scaling-wax tops, breaking the material with a hammer.

Thus you can make your batteries work to the limit for you and be estimated that you have got the utmost from them.



Here is a horograde loudspeaker that is very a simple to construct. Lay one of the phones of a your head set on the table, face appeard. On this phone place a long, tabular tis hore about.

16 inches long. Remove the light built from a reflector desk fourp and place the reflector a few inches above the upper opening of the horn. The light reflector will act as a sound reflector.

ACCORDING to recent estimates, more than 90 per cent of all vacuum tubes sold never live their full and intended life. Abuse and carelessness on the part of the users are given as the reasons why more than 2,000,000 tubes were sold last year

You can make your tubes live longer if you light the filements just up to the point of required loudness and no more. If you turn them on full blast, they will burn out rapidly, causing weak and distorted signals.

To guard against the danger of blowing out your tubes by high voltage from the B battery, through an acci-

dental short circuit, be careful to disconnect the positive wire of the B battery before changing wires or switching a tube.

If you are experimenting, it is a good plan to arrange a single - pole, double - throw switch somewhere on the table to open the circuit while making changes.

A DEFINITE color code for battery wires will aid you in distinguishing quickly between the various wires, and so may save you a lot of worry and expense. You can purchase bell wire with insulation in several different colors. Use

a different color for each lead, perhaps as follows:

Red—30-volt positive B-battery wire. Red and white—22 \(\frac{1}{2} \) volt positive B-battery wire. Yellow—negative B-battery wire. Green—positive A-battery wire.

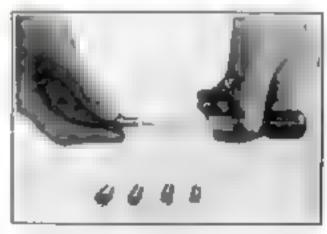
> Green and white negative A-battery wire.

Remember that red and red and white indicate danger to your tubes.

FOR small soldering about your set, soldering coppers to suit the conditions can be made from No. 4 copper ware. In one end of three - Inch. length, drill a hole for the insertion of an Iron handle wire. The other end can be sawed or filed to the shape desired --- a point or a wedge.

Another way is to wind the copper wire around your soldering tron, letting the end of the wire extend be-

yand the point of the iron. The heat of the Iron then will keep the sordering copper bot while the job is being done.



For the sian who builds his own set this fivein-one detachable socket wreach is an unusually bondy tool, separially for tightening parts and connections. Five interchangeable sockets of various sizes fit over a handle renembling a long according in appearance

THE use of copper ribbon for acrials instead of ordinary solid or stranded wire in becoming increasingly popular with experimenters, because its large surface offers comparatively little resistance to the high-frequency currents.

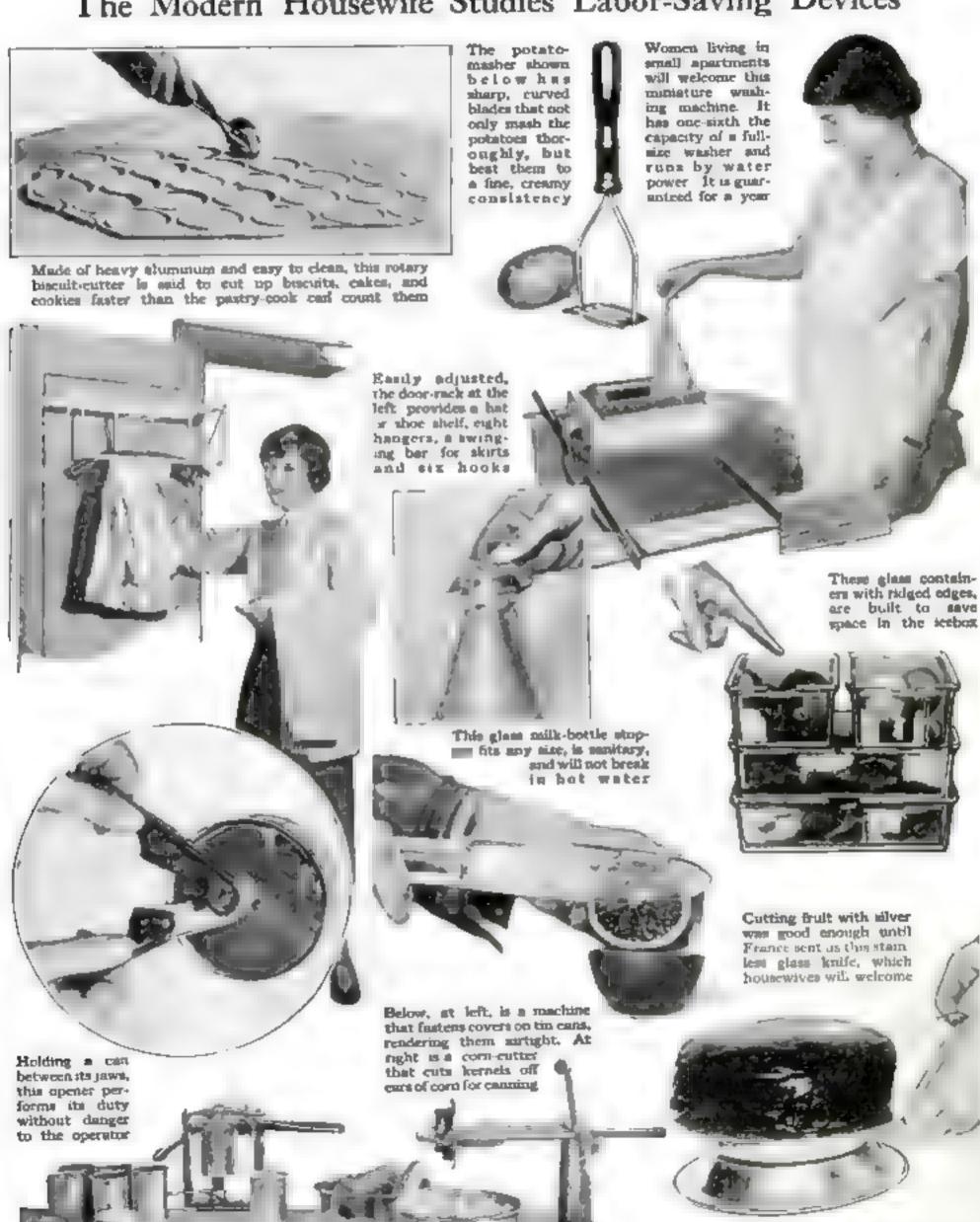
One objection, however, is that it presents a flat side to the earth, and so acts as a condenser with fairly high capacity. To avoid this, the ribbon can be twisted like a stick of sugar candy, so that the flat surface is presented alternately. This cuts the capacity in half.



Two pie-pans that pivot on each other form a revolving stand for king cakes. When not used for that purpose, they may be used as two ordinary pie-pans

Keeping the Kitchen Up-to-Date

The Modern Housewife Studies Labor-Saving Devices



How to Build

A Garage to Fit Your Car

An experienced architect tells you how to house your automobile most conveniently at the least cost

By G. Gouverneur Ashwell

A FEW years ago a private garage—
that is, one maintained by an automobile owner to house the family
car—was likely to be anything from a
converted woodshed or chicken-coop to a
remodeled barn or cottage. Now, though,
that the automobile has become an emen-

garage, guided by the over-all measurements of his car. He failed, however, to consider his front and rear humpers. As a result, he couldn't close his garage doors.

He thought it would be necessary for us merely to remove the rear wall of the or more from adjoining property, and, since this garage already was three feet from the property line at the rear, we had to make the addition at the front of the building

Similar requirements are made by the fire department or building department of virtually every town and city of the United States, so, if you contemplate building a garage, be sure, before the work is begun, that either you, or your architect or builder, submit the plans to the local building authorities for approval. This will save you from possible trouble later on.

Now, as to the size a garage should be. A Ford touring-car or sedan will fit comfortably in a space 12 feet long, five feet six inches wide, and six feet six inches high. Medium-priced cars vary in length from 15 to 17 feet; a Packard Standard Eight is 16 feet 10 inches long; a Cadillac, 16 feet. The medium- and higher-priced cars are about six feet in width and something less than seven feet high.

However, it would require more than expert aim to get any of these cars in or out of a garage the dimensions of which are exactly those of the car, without tearing off a mudguard or carrying away a

doorpost of the garage. In other words, a close fit for your car is not to be sought in building your garage. You must allow plenty of room for clearance.

A safe rule is to make your doorway opening at least two feet wider than your car, and two feet higher. The latter

part of this rule, though, is elastic, for the height of the doorway must be increased if the run-way leading from your driveway to the garage floor level is steep, or if you are in the habit of carrying articles on the roof of your car.

The doorway of a one-car garage should rarely be less than nine feet in width. For Fords, 714 feet will suffice in a pinch; for other cars 814 feet may do; but for all cars

You can, of course, make the interior of your garage the same width as your doorway. Be sure, though, that you

allow sufficient space to get in and out of

PIG. 4

PIG. 5

PIG. 5

PIG. 5

PIG. 5

PIG. 6

Place, prepared by the author showing three types of garages. Which lits your needs best? Fig. 1 shows a very complete but compensatively costly, garage for the medium-sized cur. It is equipped with its own heating plant as shown in the floor plan directly below the sketch. Fig. 1—Ploor plan for a two-car garage. Fig. 3—Sketch and plan for small-cur garage. Fig. 4—Plan of floor drain with pipe to sower and vention to energy fumes to roof.

tial part of the home—a nort of livingroom on whoels—we house our cars in
buildings constructed exclusively for that
purpose and supplied with conveniences
that make the operation of a car more
pleasurable and its care less of a task.
More, we build our garages in good taste
so that they increase, rather than mar, the
appearance of our homes.

First of all, a garage must be large enough to accommodate the car that is to occupy it. That may seem like an unbecessary statement, yet only a few weeks ago a man called at my office to ask me to prepare plans for the enlargement of his garage. He had bought a new home, and had attempted to construct his own



How a small-cur garage was expended to easier room for a larger car-Rather than go to the expense of extending the size of the whole building, the owner rusply built a small addition at the rear whore less head room naturally is required when the car is run in. Incidentally, the addition provides a support for the radio acted most

building and add an extension, but I found upon consulting the building inspector of the town that this was quite impossible. The local building ordinances required that garages be placed three feet

the car and walk around it in comfort. An inside width of from nine to 9½ feet is essential for this, while from 10 to 12 feet is better still, for in most garages space must be provided for the storage of garden tools, hose reels, lawn-mowers, baby-carriages, children's bicycles and wagons and similar appurtenances of family life.

THE minimum length of a garage for practicability is two feet longer than the over-all length of your car, including bumpers. However, as in the case of the width, it is poor policy to figure too closely. An extra two feet in length to allow for a workbench will prove a great convenience. You also will add to your convenience if you place a door, two feet als linches in width and six feet eight

or locust, from 2 1/4 to 8 1/4 feet into the ground, depending on the depth of the frost line. If brick or concrete is used for piers, they should be eight inches square. The posts should be placed from three to four feet apart and protrude from six to eight inches from the ground. One post should be at each corner and one under each doorway post. Nail boards to the maide of these all around from ground to top, saw off the tops level and square. Fill the floor from four to six inches deep with cinders or broken stone; tamp, wet down, and roll well.

On the posts or piers, except those at the main doorway, nail a two-by-four—better a four-inch-square spruce or hemiock plate. On this erect four-by-four door and corner posts and two-by-four stud-

seven-eighths inch by an inches will do for a rafter ridge.

The rafters may be covered with a neven-eighth-inch tongue-and-groove boarding, and thus covered with good grade ter felt, asphalt, or patented roofing, in rolls or shingle effect, or the roof may be shingled with wood or ashestos shingles, laid on seven-eighths by two-inch shingle teth. The rafters should hang over the walls at least 12 inches.

THE side walls may be covered with novelty or beveled siding, directly on stude, or with seven-eighth-inch sheathing boards and building paper beneath, the latter being tighter and warmer, but costing more. Or the stude may be covered with seven-eighth-inch hourding and shingled with wood or patent tarred felt shingles. Metal lath and one-inch Portland cement and sand stuces (proport one one to two is another first that may be applied to the side walls. The can be finished in many



inches high, opening outward, in the side wall opposite the driver's seat. This door should have a glass upper half panel.

There should be one window in this wall, two in the other side wall, and at least one in the rear wall. Plenty of natural light will make it easier for you to work around your car and also save you money in electricity; for, if possible, your garage should be wired for electric light. Also it will be just that much better if it has a cement floor and runway, drainage, heat, and water supply.

HOWEVER, the first purpose of a garage is to supply adequate shelter for a car, and if it fuifils that purpose, many other details may be dispensed with, at least until you feel you can afford them.

The least expensive type of garage resembles an old-time shed or farm-wagon house. A garage of this kind you can build yourself, if you are handy with tools, at a total cost of from \$50 to \$100, depending on prices in your locality and the kind of materials you select. If you have not time to attempt the work yourself, you must add four or five days' carpenter labor to the cost of materials. Since the construction of this type of garage is fairly typical of all, I will describe it briefly

Sink six-inch posts of chestnut, cypress

ding, eight feet long, from 18 to 20 inches on centers. Top off the studding with a four-by-four rafter plate. Rafters may be two-by-four, or, if the snowfall is light, two-by-four, set 18 inches on centers. Two-by-four tie beams, four feet apart, must cross the garage from the top of plates and be spiked to rafters. A board

Points to Remember

MAKE the opening of your garage doorway at least two feet wider than your car, and two feet higher.

Be sure your garage is at least two feet longer than the length of the car, including bumpers.

See that you have good ventilation, especially in the built-in garage, to safeguard you against the danger of gasoline fumes and poisonous carbon-monoxide gas from the exhaust.

Beware of open heating plants, such as gas, oil, or coal stoves.

Take care to comply with building and fire ordinances of your city or town. Dressed pine or cypress, 1 1/4 inch by two, should be used for doorway trim and at corners if siding on walls is installed.

For doors, plant battens, similar to the conventional barn doors, should be used. These can be constructed of saven-eighths by six-inch tongue-and-groove boarding, with three battens, 1 4 by eight inches, on back of each door—one across the top, one across the bottom, and one diagonally from top to bottom. Heavy iron strap hinges should be used.

PAINTED to match your house and partially acreened by shrubbery, a garage of this cort will fit into almost any neighborhood. A light cornice of aimple stock moldings along the saves and up the gables will improve its appearance but add to the cost. Windows, a cement floor, and similar features may be included if desired.

Although this type of garage will house any cur satisfactorily, if constructed in proper size, it is particularly adapted to

the Ford or other light car

Probably a more substantial type of garage will be desired, particularly by persons who own medium-priced or high-priced cars. The floor space in a garage of this kind should be not less than 10 by 22 feet for one car, or 20 by 25 for two, although 12 by 25 and 24 by 25 are better.

(Continued on page 161)

When Your Engine Misses

It may be faulty ignition —What to do and how to do it -An expert's time- and labor-saving hints for your car—Vital parts of the ignition system and how to test them

By George A. Luers

"I'M DISCUSTED with my car," a friend of mine said to me the other day "And it's all because the spark plug of one cylinder persents in getting fouled. Yesterday while I was out driving I had to replace the plug in that cylinder four times in 20 miles. The ofth time the plug fouled I had run out of spares, and the only thing left to do was to take it apart on the road, clean it, and replace it."

One hardly could blame this motorist for being out of sorts with his car. In an effort to find and remedy the trouble, he had spent considerable time and money, apparently in vair. He had a new piston fitted to the troublesome cylinder and the piston refitted with apacial oil seal rings. In aid tion, the sylinder had been reground.

A FEW days after he recited his troubles to me, my friend, quite by chance, met an electrical mechanic to whom he told the same story. The mechanic became interested enough to examine the engine. Inspection showed that all electrical terminals were in good contact, and that all the units of the ignition system apparently were functioning properly. By the process of elimination, he decided that the trouble must lie in the only vital moving part of the circuit—the circuit-breaking mechan-

And here the whole disturbance was traced to an unusual cause. The cam operating the circuit breaker was found to be worn at its extreme end. Whenever the engine was speeded up, this

worn spot failed occasionally to close the circuit, causing the engine to miss. Thus one small worn spot that could be remedied for about a deliar had resulted in a lot of unnecessary work and expense for repairs.

I have recited this experience simply to point out the importance of gaining a working knowledge of the ignition system of your car. For while the ignition system is equally, if not more, important than the fuel system, its difficulties are more clusive. A leakage of fuel becomes evident immediately, whereas a leakage of electric current, while fully as vital, may not be detected unless you are acquainted with the various faults and troubles to which an ignition system is subject.

The usual ignition circuit consists

parts, or in the connecting wires, will interfere immediately with the proper firing of the cylinders, and it will be necessary to repair the trouble to obtain satisfactory operation of the engine. What repair to make depends upon your ability to trace the ignition current from its source to the final operation in firing the cylinder charge.

To test the primary circuit—the low-

voltage circuit from the battery to the coil-a small test lamp or ammeter generally is used, while a spark gap is a method of testing the flow of secondary current, which is the current from the coil to the spark plugs. The spark gap, which is simply an opening in the elecuit, can be obtained by removing a plug terminal about an eighth of an inch from the top of the

The purpose of such systematic care of the ignition system is to maintain the original condition of the circuit. In other words, it is to see that all terminals are clean and tight, that the wires are free of breaks or abramons, that the circuit breaker is in adjustment, that the switch is traking positive contact, that the coll is dry and secure, the dustributor parts intact, and the apark plugs in good con-

BEGIN with the battery terminals. These become sulphated and must be cleaned, tightened, and coated with vaseline periodically.

The battery wire should be inspected for abraded sections and protected with strips of

linen or cloth shellacked over any work

Where any wires are adjacent to metal, it is advisable to tape them. Where they are in the vicinity of the engine, where oil would reach the tape, they should be wrapped with a shellacked strip of cloth that will not loosen when oil comes in contact with it.

The ignition switch on the dash should

What to Look for when Your Ignition System Fails

BELOW is a list of the things that may cause the ignition system of your car to go wrong. It was compiled by Mr. Luers from a long study of service-station repairs.

Cut out this list and tack it up in your garage for ready reference. It may save a lot of time and expense.

Here are the troubles to look for:

Disconnected terminal or wire. Spark-plug gap too wide or closed. Oil, water, or dirt in circuit breaker. Water or "short" in distributor cap. Grounded primary wire. Wear or weak spring in the circuit breaker. Distributor cap loose or displaced. Pitted or defective contacts on circuit breaker. Breaker contact points out of adjustment. Ground in secondary wiring. Spark pluga dirty or carbonized, Spark-plug porcelain cracked. Defective coil. Defective contact at ignition switch. Leaking secondary cables. Ground through armored cable. Spark timing incorrect. Broken wire inside insulation.

ementially of the following units, which are shown diagrammatically at the foot of page 89

Current source, battery, or generator. Swatch

Circuit brenker

Spark-plug wires misplaced.

Cod

Distributor. Spark plugs.

Difficulties or breakage of one or more

be tightened, using a screwdriver and pliers to set up the small screws and nuts. The nuts of all terminals have a tendency to become loose, due to the vibration of the engine. Small lock washers such as are used on spark-plug central electrodes are serviceable guards against the nuts' backing off.

See that the circuit breaker is in

going over the system, it is well to examine especially the portions that have been bent. An inside break of the wires can be felt through the insulation with the fingers. Armored wires are subject to "shorting," due to the fact that the armor sometimes will cut into the insulation. This condition can be determined by use of a test lamp. The remedy is to cut

SPARK PLUGS CLEAN, ADJUSTED AND DISTRIBUTOR PARTS CLEAN, PORCELAIN FREE BURNED PARTS RENEWED OF CRACKS AND CASING FREE OF BATTERY TERMINALS CLEAN IGNITION SWITCH AND TIGHT TIGHT AND ADJUSTED FOR WEAR WIRE END TERMINALS SECURE TO WIRES AND WIRING PROTECTED AGAINST CHAFING PREFERABLY HELD with Lock Washers IGNITION WITHOUT BREAKS: CIRCUIT BREAKER. COIL THOROUGHLY DRY, INSIDE INSULATION CONTACTS ADJUSTED WIRING INTACT AND COIL AND SHORT CIRCUITS AND SMOOTHED BY SECURE IN HOLDER ALONG THE CHASSIS FILE AND MOVING PART'S FREE OF WEAR

This diagram shows the important points to look out for in everhousing the ignation system of your car. Bystematic attention to these items will maintain the circuit in good working condition

adjustment and that the contact points will snap in and out of contact with the movement of the breaker cam. The contact points should be separated a distance of at least a thirty-second of an inch.

THE points are made either of tungsten or platinum, and these must be made flat and even, free of ragged ends or pit marks, and rubbed with a Swiss or jeweler's flie between the ends. The metal is thin and for that reason excessive filing must be avoided

Wear of the roller, cam, or moving parts inside the igniter circuit breaker should be subjected to careful inspection. Frequently small particles of metal will be found inside the case, and this condition should be noted as a possible cause of future trouble. No attempts should be made to open the coil. The only work required here is that of making the contacts tight and also tightening the coil holder, for the holder is frequently a ground connection, and when loose will interfers with ignition.

The distributor rotor gradually will be burned away, though this condition will be found only after long use. The distributor cap requires little attention except to make sure that the anap fasteners and positioning pin hold the cap solidly against the distributor case and give the cap its proper relation to the rotor

Spark plugs should be cleaned occasionally and inspected for eracks in the porcellan. The points should be adjusted to compensate for the metal burned away in use. The gap of the plug should be set at one thirty-second of an inch. This close gap will allow for the burning away of some metal without the necessity of adjustments.

All wires are subject to possible breakage from bending. For that reason in the armor back and tape up the broken area.

The best methods of testing ignition units, and so saving yourself repairs and replacements, are so follows

To test the coil, attach one end of a wire to any part of the engine or car frame

and bring the other and within three-sixteenths of an inch from the attachment of the high-tension wire leading to the rotor of the distributor. When the engine is cranked by hand, a spark occurring at this place indicates that the coil is in good condition. Where the ignition circuit up to this point is intact and no spark occurs, the coil is defective and should be replaced.

HE first step in testing the ignition circuit breaker is to try out the ignition circuit up to the distributor by disconnecting the wire and testing it for sparking against the frame or engine. A spark will indicate that current is reaching the breaker. Revolve the motor to close the contact points in the breaker, and after replacing the removed wire, disconnect the wire leading to the coil. Strike the terminal end of thus wire against the terminal of the coil.

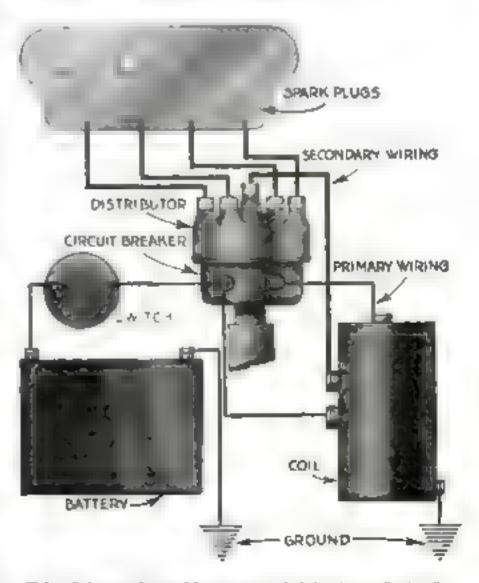
Absence of spark indicates a possible ground in the breaker mechanism, defective contact points, a weak breaker-arm spring, or other faults inside the breaker.

An open circuit in the ignition switch may be revealed by an absence of sparking when the wire is removed from the circuit breaker and touches the frame or engine. Another way is to "short" the switch by means of a wire from the battery terminal of the switch to the ignition wire leading to the circuit breaker. When this connection gives ignition current, the switch is faulty and requires repair.

WHERE the coil test shows that current is delivered to the distributor wire, fadure to deliver to the spark plugs is due to some fault in the distributor, such as water, burned contacts, or short circuit in the rotor. Removal of a spark-plug wire while the engine is turned by hand or by means of the starter, will show whether the current is delivered to the plug. If the distributor is water-soaked, dry it inside and out. If the rotor and contacts are burned away, replace parts. A cracked distributor cap with water in the crack sometimes will lead the current to ground, and so break the circuit.

I believe that if you will follow these suggestions, first studying the ignition system to gain a thorough knowledge of its operation, then taking systematic care to keep the circuit in good condition, and finally, if anything goes wrong, applying the simple tests I have described, you will find that your car will give you better, more consistent service at less expense.

A DDITIONAL information on how to time the ignition system will be found in a useful article by Ray F. Kuns in the Home Workshop Department, page 126 of this jame.



Units of the complete spattion system and their wiring. Brady of this disgram is connection with the accompanying criticle will give you a new knowledge of how the system works, and so will sid you in locating any troubles that may arise in your auto cogine

How to Cut Your Car Costs

Keeping an Auto

CHOKER ROD

6 SLOTS CUT

DRILLED AND TAPPED

Fig. 3. Bushing tool

A HACKSAW

BUSHING REMOVER

PLUG

NE cold winter morning, when Johnston stepped on the starter of his car, the engine heatated momentarily, although it finally turned over and began to run. The radiator that morning was frozen, but Johnston attributed this to running the car out in the cold. For several months afterward he noticed that on

long-continued runs the engine boiled. Finally, when the car was placed in the repair shop, he learned that the retaining pin of the pump rotor had been pheared.

Unquestionably this had happened on the frosty morning when the radiator was found frozen. The car had been driven continuously since that time with the pump failing to deliver any circulation.

Johnston then made use of two simple methods (Fig. 1) for testing whether the pump rotor is broken or if the radiator is frozen.

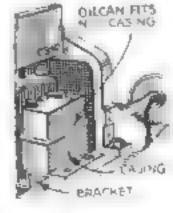
Two holes are tapped through the pump easing directly opposite the hub where the shear pin is placed, and small pipe plugs are set into

them. By removing the upper plug it is possible to determine if the pump propeller revolves with the shaft whenever the car shows signs of overheating, and the removal of both pluge makes it a simple matter to renew the dowel pan quickly.

The test for freezing is made by preming between the fingers the lower rubber hase. connection to the radiator. When frozen or partly frozen the hose dose not collapse readily and it is necessary to thaw it out.

SIMPLE method for making the choker rod on light care self-retaining in to cut notches in the rod with a hacksaw blade (Fig. 2). This may be done while the rod is held out by hand or after it has been removed. The notches will engage the lower edge of the hole through the dash, thus holding the choker rod in any one of several positions. Six notches are sufficient for all ordinary purposes.

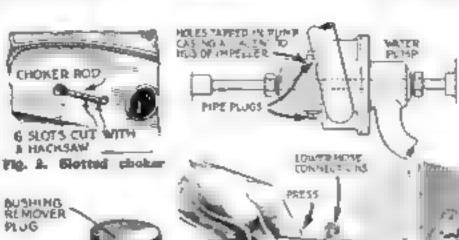
THEN new piston-pin bushings are purchased by a carowner he often han trouble both in extracting the old bushings and Inserting the new ones. The simple tool shown in Fig. 2, however, makes this work easy.



Otlors carrier

A bar 34 by $1\frac{1}{4}$ by 6 in. is drilled and tapped to take a \$6-in. screw. This screw is about 5 in. long with a crank fitted to it either by welding or forging. A plug is turned as shown, so that its larger diameter will





Cold-weather touts for water circulation

These are kinks that every autoest should know



Replacing boly

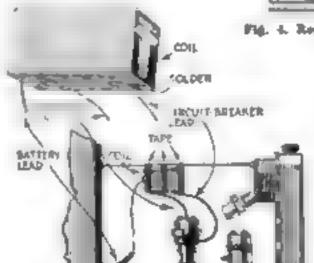


Fig. J. Aubutlture for burnt-out ignition-coll

pass through the hole in the piston into which the brouse bushing fits. The smaller part of the plug is made the size of the puston pin.

To remove a bushing, the tool is set as indicated and the screw turned by means of the crank. A new bushing is inserted by placing it over the screw before the latter is started in the threaded bar. Turning the crank then forces in the bushing.

A boss should be provided where screw and crank units so that a stubborn bushing may be started by tapping against the bom with a hammer after pressure has been applied with the screw. - GEORGE G McVicken, North Bend, Neb.

IF A reamer is not at hand for fitting a new piston pin or bushing, place the new pin in the new bushing and, after removing the old bushing, drive the two into the connecting rod or piston, as the case may be. Placing the pin inside the hushing prevents the bushing from becoming distorted.

in Good Condition

Drive out the pin and see if the old pin will start into the new bushing. If it will not, grind one end carefully until it will. Then work some grinding compound into the bushing from both ends, turning the pin around and around. Use only one and so that the pin gradually will become tapered. In this way you can grind the bushing to any desired size.

Clean out the compound at intervals and try the new pin. A little oll on the new pin will allow a closer fit than if the pin la dry. This will give a very smooth and perfect fit.-E. B. STAPLES, Eureka Springs, Ark.

IF YOU should happen to be 1 driving a Ford in the country and a spring-shackle bolt enapped, what would you do? If you have a spare inner tube, take out a valve stem and insert it in place of the broken bolt (Fig. 4). The writer has witnessed this very simple repair and the substitute bolt is still in place after several months, -Samuel Hagerman.

WHILE touring recently, a friend of mine burned out the ignition coil. The only repair man in the neighborhood had nothing but a few spare parts for light cars, yet

he fixed the ignition system fairly well with a substitute coil. This was made from one of the small box coils that are used in combination with the magneto ignition of small care.

Three insulated wires were soldered to the contact points on the coil casing and connected, as shown in Fig. 5. The distributor connection was made with a high tension wire. The vibrator of the coil was bridged by screwing the contact points solidly against the cure of the coil

AFTER twice losing a gallon of oil when the can overturned in its place under the engine hood, one motorust made up a rectangular shaped casing as shown in Fig. 6. Thus just fits the can of oil.

It not only saleguards the oil, but also prevents the can from against jolting the carburetor, generator, and adjoining parts.



NOTICHES FOR GRID

Fig. 7. Short ecrewdriver

TO REMOVE the magneto terminal from a car equipped with the flywheel type of magneto. requires a short

special type of screwdriver, unless the engine has been removed from the car. A special acrewdriver to serve thus purpose may be made quickly and cheaply from an old valve, as shown in Fig. 7.

Llome Workshop

s Tree

Mountain

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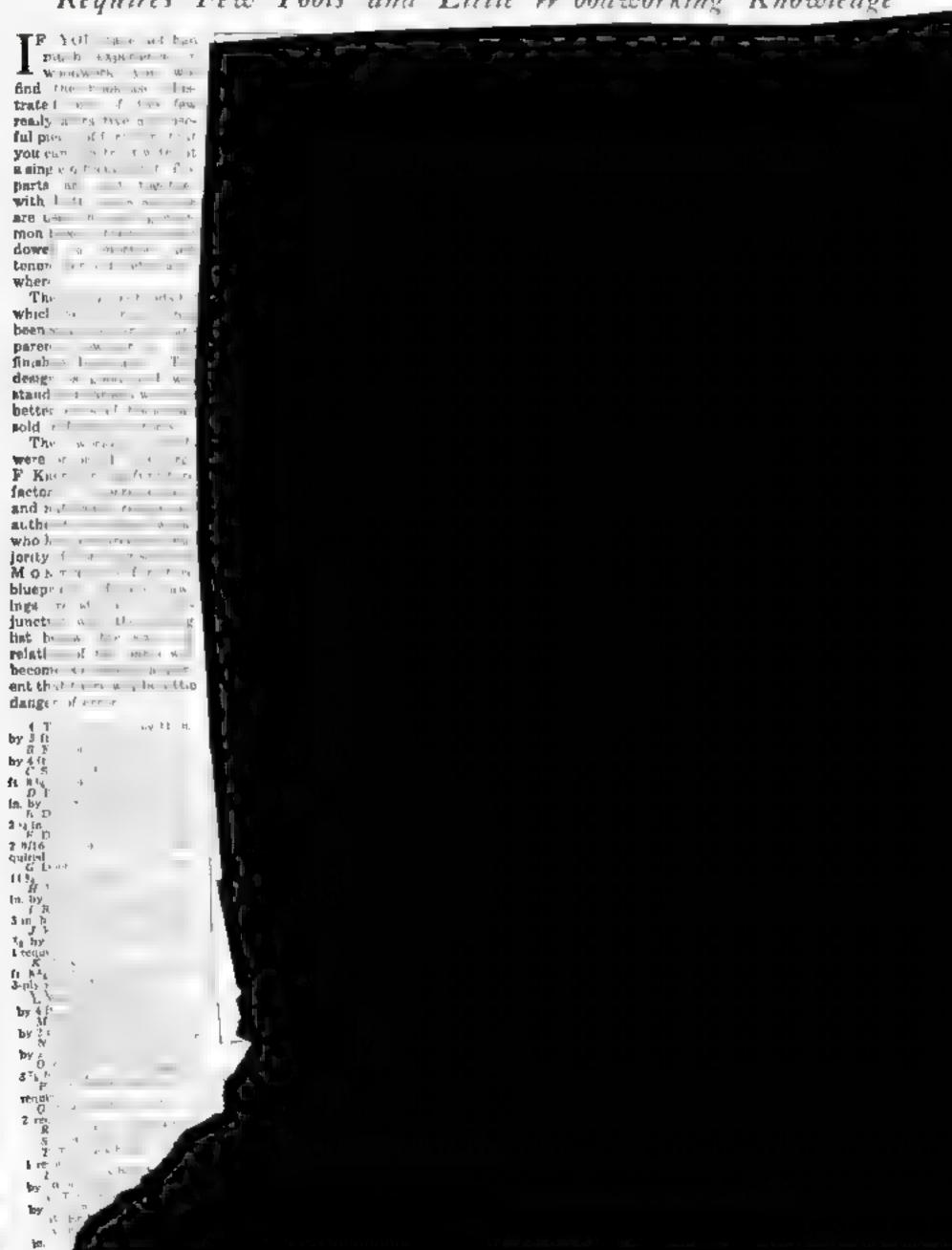
should be water if pothing team a mountain pool in a with precip thus wase rising des. such as is shown to the ground of the partographs. It there is to setting up the

The surface moneting will not as easy and inscring up work dipped to a solution of us to water is the modeling of As the plaster hardens to mix rut more than a lie it of a consistency reast. That news-veries to size for any tile pieces, with pieces,

while

A Bookcase Easy to Make

Requires Few Tools and Little Woodworking Knowledge





is Tree

Mountain

e upon which to build the cay be made of boards, a wallboard, several thick-d heavy wrapping-paper, by, or a furniture cover, g that will protect the U do. On the center of the a box to support the for and mountain foundable the up until the model is

ower photograph suggests suid a foundation of wallor the mountain. Heavy rd such as is used for food may be substituted. Your an supply these cartons, and sud fiberboard can be by with a saw

general shape of the founshould be that of the lower frustrum of a four-sided d. Portions of the sides a cut away as shown for entrances, for chasms and formations. And foundafor peaks may be built of

ar-shaped pieces added to see as indicated.

olning edges of the wallor fiberboard may be fastogether with strips of paper
more conveniently handled
passe-partout paper used in
if pictures, or gummed paper
scaling packages. Upon the
you may indicate in pencil
, trails, guiches, and peaks
med in the surface modeling
iding trail indicated upon the
n the photograph.

should be water, if nothing than a mountain pool in a with precipitous walls rising does, such as is shown in the ground of the photographs. all there is to setting up the

The surface modeling will be sound just as easy, and fascinating work. Newspapers dipped in a solution of plaster of Paris in water is the modeling material to use. As the plaster hardens rapidly, it is best to mix not more than a pint at a time. Make it of a consistency a trife thicker than cream. Tear howepapers into pieces of convenient sits for dipping, and after immersing the pieces, transfer them to the model and press into the forms desired.

The newspaper printing will show while (Continued on page 134)

tain shown in the photograph makes a pleasing tree base. Besides adding mution to the scene, the railroad will stimulate fresh interest in the toy, and suggest the purchase of accessories in equipment for the boy's gift this year.

The tree-base model may be large or small, according to the space available. Indeed, the idea may be adapted on a generous scale to add novelty and distinction to a community Christmas tree or one prepayed by a church or fraternal society



How the foundation is made of wellboard or fiburboard featment together with adhesive tape

for the entertainment of the young folks.

That shown in the accompanying illustrations measured 5 ft. long and 4 ft. wide, which is about right to accommodate the circular track of the ordinary toy electric railroad.

A Bookcase Easy to Make

Requires Few Tools and Little Woodworking Knowledge

F YOU have not had much experience in woodwork, you will find the bookcase illustrated one of the few really attractive and useful pieces of furniture that you can construct without a single difficult joint. The parts are put together with butt joints such as are used in making common boxes; there is not a dowel, a mortine and tenon, nor a dovetasl anywhere.

The unique methods by which the construction has been simplified are not apparent, however, in the finished bookcase. The design is good and will stand comparison with the better class of bookcases sold in furniture stores.

The working details were prepared by George F Kaercher, the furniture factory Riperintendent and nationally recognized authority on cabinet work, who has prepared the ma-Jority of Popular Science MONTHLY'S furniture blueprints. If these drawings are studied in conjunction with the cutting but below, the alze and relation of the parts will become so clearly apparent that there will be bittle danger of error

A Top of case, 14 by 11 in.
by 3 ft 1 required

B Ethin of case, 36 by 10 14 in.
by 4 ft 20 36 in., 2 required

C Shelven, 36 by 9 1, in, by 2 ft.
8 16 in., 4 required

D Bottom of case, 14 by 9 1, in, by 2 ft.
8 Door attles, outside. 14 by 9 1, in, by 2 ft 8 2, in., 2 required

F Door at ea, center, 36 by 2 ft. in, 2 required

G Door ralls, 16 by 1 ft. by 11 hy
11 M n. 4 required

H Door antragal, 16 by 19
in, by 4 ft. 3 14 in., 1 required

I Rail at top of doors, 16 by 3 in, by 2 ft. 8 32 in., 1 required

J Rail at bottom of doors, 14 by 3 in, by 2 ft. 8 32 in., i required

K Back of case 3, in, by 2 ft. 8 34 in., 1 required

K Back of case 3, in, by 2 ft. 8 34 in., 1 required

K Back of case 3, in, by 2 ft. 8 34 in., 1 required

L Back strips, 12 by 13 in, by 2 ft. 8 35 in. 2 required

M Baseboard, 14 by 13 in, by 2 ft. 8 35 in. 1 required

O Baseboard returns 36 by 3 14 by 10 by 2 ft. 8 35 in. 1 required

O Baseboard returns 36 by 3 14 by 10 by 2 ft. 8 35 in. 1 required

3 % by 10% at, 2 required

P Top filling returns, % by 3 by 9% in., 2 required

() Base filling returns. % by 1% by 9% in., 2 required

R Poet, front, 36 by 4 by 4 in., 2 required
S Fret back, 36 by 2 by 2 in., 2 required
T I'-p back board, 36 by 3 55 in. by 2 it 10 55 in.;
Prophack board overlays, partiale, 1/16 by 1 1/6
by 10 in. vences 2 required

V Top back board overlay center 1/16 by 1/6 by 1/6 by 1/6 in . required

W End overlays, 1 16 by 2 by 9 in. B required, X Frieze overlays, outside, 1/16 by 2 kg by 5 kg in , required 7 Friese overlay, center; 1/16 by 2 k by 18 kin., 1 required
Z Had overlays at top, 1/16 by 1 k by 9 bu;
2 required
AA Door moldings (stock), 9/16 by 5 to by 11

AA Door moldings (stock), 9/16 by 5 in, by 11 ft , 2 required BB Top back cleats, 1/2 by 3/2 by 5 in , 2 required CC Glass back molding, 1/2 round, 3/2 by 3/2 by 11

ft.; 2 required DD Hinges, bett of half surface, 2 by 234 lp. brass; 6 required

brass; 6 required

EP Pushbutton catch with or without lock, or other door catch or lock brass; I required

FF Scienced sheet glass, double thick, for doors

Either oak or whitewood may be used

(or other woods, if the builder desires). Even if the case is oak, the items C, D, J, M, P, and Q need only be whitewood

The top of the case is held together by fastening the pieces M with screws or nails to the top, A, and the sides, B Fastening the pieces P inside the ends at the top gives additional nailing places for the upper rail, I

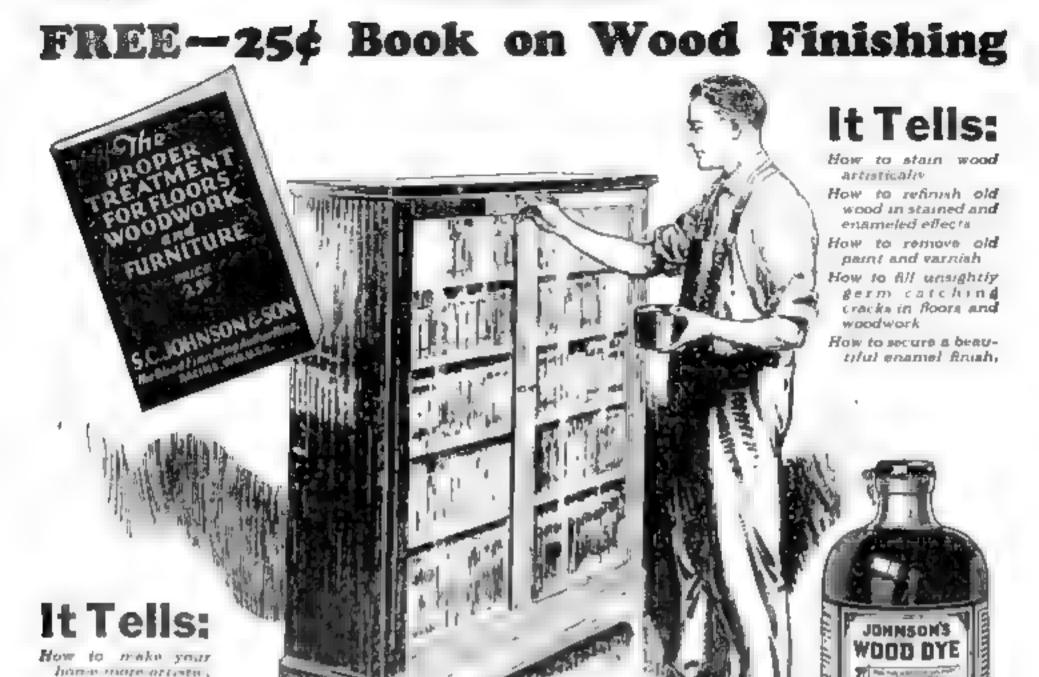
At the bottom the construction is (Continued on page 150) Cheer avail to my

How to keep floors woodwork and furniture in persect

How to finish soft and

condition.

hard woods



If you have a hobby for making cabinets, furniture, radio boxes, etc., you will find our Book invaluable. For, naturally, you want to give your handlwork a beautiful finish. Our Book gives complete instructions for finishing all wood, hard or noft, old or new. Tells how to make soft woods beautiful as hardwood. It is the work of experts—beautifully illustrated in color. Gives covering capacities, includes color charts, etc. Use coupon below.

JOHNSON'S WOOD DYE

Johnson's Wood Dye is very easy to apply. It dries in four hours and will not rub off or smudge—penetrates deeply, bringing out the beauty of the grain. Johnson's Wood Dye is made in 16 popular shades as follows:

No. 128 Light Mahogany No. 125 Mission Oak
No. 129 Dark Mahogany No. 130 Weathered Oak
No. 127 Brown Mahogany No. 110 Bog Oak
No. 329 Red Mahogany No. 172 Flomish Oak
No. 120 Furned Oak No. 178 Brown Flomish

No. 120 Furned Oak No. 178 Brown Flemish No. 123 Dark Oak No. 131 Wainut

No. 126 Light Oak No. 140 Early English

No. 124 Golden Oak No. 180 Gray No. 160 Brown Oak

All shades may be easily lightened, darkened or intermixed. Full directions on every label. Select the shade of Dye you want from the list above and order it from

your dealer by name and number.

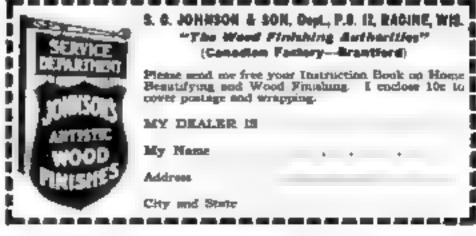
S. C. JOHNSON & SON, RACIRE, WIS.

"The Wood Finishing Authorities"

Johnson's Wood Dye is a dye in every sense of the word. It contains no finish whatsoever. Like most first class products it answers one purpose only—it dyes the wood—the finish must be applied over it. We recommend Johnson's Varmishes or Johnson's Polishing Wax.

No. 225 Days Del

Stores displaying the Johnson Service Department Sign carry a complete stock of Johnson's Artistic Wood Finishes and will be glad to show you finished wood panels—and answer questions on how to finish wood the proper way and give you a copy of the Johnson Book.



How many radio miles did you go last night?

HOW many radio miles did you travel last night—that's the up-to-the-minute question. Did you voyage from New York to Chicago? Did you look in on Boston fifty seconds after, and on Philadelphia half-a-minute after that? If you didn't, why didn't you? There's fun and excitement, too, in a De Forest Radio—and it's ready to "get to work" five minutes after it enters your home.

Here is a Radiophone so astonishingly simple for the work it does that it's your best introduction to the marvels of radio space. Here is one so perfectly developed that it invites graduation from other less efficient instruments.

Here is a receiving set sponsored by the very genius who made radio, as we know it, possible—an instrument which offers a really remarkable demonstration in radio performance at a price far less than any instrument whose achievements compare with it. Here is a practical, a modern Radiophone, depending upon no out-strung wire to obtain results, but which, with a simple loop the size of a picture frame, opens to you a far-flung range of concert, speech and lecture—and all with a tonal purity, a sensitiveness of choice that is rare to any but De Forest users.





DE FOREST RADIOPHONE

For Beauty and Clear Reproduction



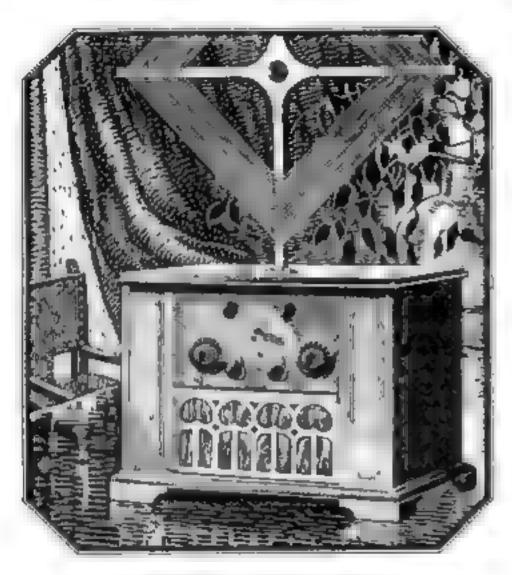
Use the De Forest Loud Speaker. It reproduces naturally, brilliantly, without distortion. The adjustment of the reproducing unit assures uniform response over entire range of audible frequencies. Its horn is shaped to retain the full brilliancy of the original sound, and also to

add volume. The complete unit is free from rattles. No rattles can ever develop. Every De Forest Loud Speaker is thoroughly tested and is guaranteed free from defects.

Sold by authorized De Forest dealers only. Price, with 6 feet of cord, \$25.00.

The De Forest Radiophone is a complete fourtube receiver, built on the best reflex principle. Its four tubes and crystal detector do the work of seven tubes with four-tube economy of operation.

We could be extremely technical in telling you how the four tubes do the work of seven and why the crystal detector gives both power and economy to this instrument. If you are technically inclined we shall be glad to do so if you will write us. Technical or not, however, know this: You can get splendid results from a De Forest D-12 Radio-phone. Its upkeep is low. Its tone is clear and pure. It can be moved easily from room to room.



DE FOREST D-12 RADIOPHONE
Seven-tube efficiency with four-tube economy.

Ask the De Forest agent to demonstrate

Why it pays to look for the De Forest agent

De Forest from first to last stands for all that is substantial and thorough and fundamentally right in tadio. De Forest agents are qualified to give you sound and practical advice and help in radio. When you find a De Forest agent you find a man who knows radio—a man who has given us his word that he will see that every instrument he sells is thoroughly inspected and properly serviced after the sale. He has been carefully picked and schooled in the operation and care of De Forest Radiophones. He will install your instrument and explain to you simply how to get the fullest satisfaction and enjoyment from it.

Avail yourself fully of his help. You will find it valuable.

Prices on De Forest D-12 Radiophones

COMPLETE

Including loop, self-contained loud speaker, four De Forest tubes, A and B batteries, and all equipment ready to operate.

With Dry Batteries

In two-tone gray and black Fabrikoid cabinet \$161.20 In two-tone Mahogany cabinet 176.20

With Storage Batteries

In two-tone gray and black Fabrikoid cabinet 180.00 In two-tone Mahogany cabinet 195.00

De Forest D-14 Radiophone

In burl walnut cabinet with loop and loud speaker built in. Price, including five DV-2 tubes, four B batteries, and storage batteries. 371.50

> DE FOREST RADIO COMPANY Jersey City, N. J.

X

DE FOREST RADIOPHONE

→ D-12 REFLEX •

Your Set Deserves De Forest Tubes

De Forese
DV- 1 Tube
for use wask
Dry Cell
Batternes

The original De Forest three-electrode vacuum tube was the first of many millions of De Forest tubes that have never been excelled in quality of workmanship, or performance. Today, as in the past, De Forest tubes are unsurpassed for giving volume and beauty of tone. They are non-microphonic. They can be used with all standard circuits. The DV-3 is for use with dry batteries, the DV-2 with storage batteries. They are guaranteed against defects in material and workmanship. Sold only by authorized De Forest dealers. Price, \$4.00 each.



De Forest DV-s Tube for nee with Storage Bassering

This seal on a radio or tool advertisement significs the approval of the INSTITUTE OF STANDARDS. See po

Easily Made Furniture Delights the Kiddies

FOR the kiddles' Christman a most useful and entertaining present is a table and set of chairs such as are illustrated. The material costs less than five dollars, yet this toy furniture is superior to store sets that cost from 15 to 25 dollars.

A careful study of the requirements was made before deciding upon the design,

and the result is a set well proportioned for children between three and 12 years, strong and durable, light in weight, and attractive in appearance. The construction is simplified so that any one handy with tools can make it at home with a saw, a 4-in, chisel, a screwdriver, and sandpaper

The pieces are made entirely of 1/2-in. wood, whitewood or poplar, oak, pine, cedar, or chestnut being satisfactory. All except the table top and seats is made from straight strips, 3/4 by 1 1/4 in., which can be had from the lumber dealer, finished to the exact size.

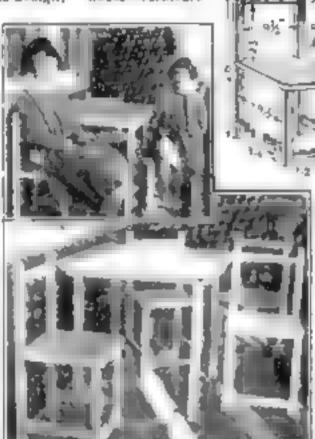
The table top is made of two 1/2 by 18 in, boards, 26 in, long These boards are laid on the floor, and the edges coated with glue; then they are forced together and left until dry. Four 19-in, long stripe of the 1/2 by 1/2 in stock are covered.

with give on one edge and screwed to the under aide of this top, forming a square frame. This braces the top and furnishes a support for the legs

The legs also are 34 by 1% by 18 in They are glued and fastened by 214-in acress into each corner of the "box" or By Homer S. Trecartin

TABLE TOP

Few tools are necemery for constructing this semple but attractive set of children's house furniture



Details of the table and chaus are shown a b p v v The completud set, composed of a table and fout chairs in the left

DEEP

LEGS X XIA

frame under the table top. The table corners are well rounded with naw, chiest, and sandpaper

All the chair legs and "stretchers" are cut from the 16 by 116 in. strips. The back legs are 26 in. long, the front legs 13% in. long, and the stretchers are 10 in. long. Each back leg has a notch or grouve for the seat cut with saw and chisel 1/2 in.

deep and 1/8 in. wide. The bottom of this notch is 1814 in. from the floor The end of each stretcher is cut down on both sides so that it is 1/2 in in thickness for a distance of 1/2 in. from the end, and grooves or mortises are cut with the chisel in the lega to fit these 1/2-in. tenons.

The scats are 12 in, wide at the back, 18 in, at the front, and 18 in, deep. A notch \$6 in, deep and 156 in, long is cut in each back corner to fit flush into the

notch in the back legs. Depressions that are 1/2 in. deep by 1/4 by 1/4 in. are cut under the front corners of the seat 1 in. in from the front edge; these receive the tops of the front legs. The front corners of the seat and the top edges are well rounded.

In assembling the chairs the mortises are covered with good give and forced together. Small angle-irons acrowed on under the seat and to each leg add greatly to the strength

When the glue is set, the articles should be rubbed very smooth with sandpaper—coarse, medium and very fine. Then a coat of paint thinned with turpentine is put on. When dry, thus is lightly sandpapered. Next a coat of auto or furniture enamel (or better, two coats) give a beautiful and durable finish that will stand repeated weekings.

An initial letter, or a simple design on each article, painted with enamel of some other color adds an individual touch that the children greatly appreciate,

"Catch 'Em Alive" Game Is Hilarious Sport

By Capt. E. Armitage McCann

THIS is a hitarious game designed as a Christman novelty for the readers of POPULAE SCIENCE MONTHLY. It will afford endices amusement for two or more players—the more the marrier—yet it can be made with the simplest of tools at a cost of next to nothing

It consists of a series of trape standing on a



Players with nets try to catch would objects shot cate the sir by concented trupe

table and hidden by cardboard or wooden acenery. The traps, released by one player, shoot butterfies, balls, birds, or other objects up in the air. The other players have to catch these in small butterfly nets.

Every object caught on its upward flight scores two; on the downward flight, one. The score can be varied, if desired, according to the rapidity of the flight. For example, a ping-pong ball will travel much more quickly than a butterfly or a bird.

To make the game, a board 18 in. or more in length and about 6 in. wide will be required. On the under side of this ecrew four or more strong mouse-traps of the fist type, obtainable for five cents each. At the point where the wire strikes when the trap is snapped, hore holes of such a size that a small ball, such as a ping-pong ball, will project alightly through them. Then, when the trap is snapped, it will shoot the ball into the sir.

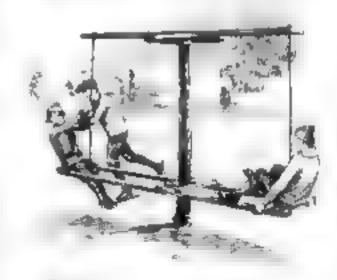
Fix this board on upright sides and a base, as shown on page 133. On the base, a little back from under the center of the traps, screw a long batten of such a length that the wire springs of the traps will just clear it. On this staple an albow catch directly under each trap. The strings to each eatch for releasing the traps. The base should be quite substantial and may be clumped to the edge of the table.

AT THE front of this mechanism erect a board or a piece of wallboard or fiberboard about 9 in, high and point it (Continued on page 133)

Merry-Go-Round Furnishes Fun for Skating Parties

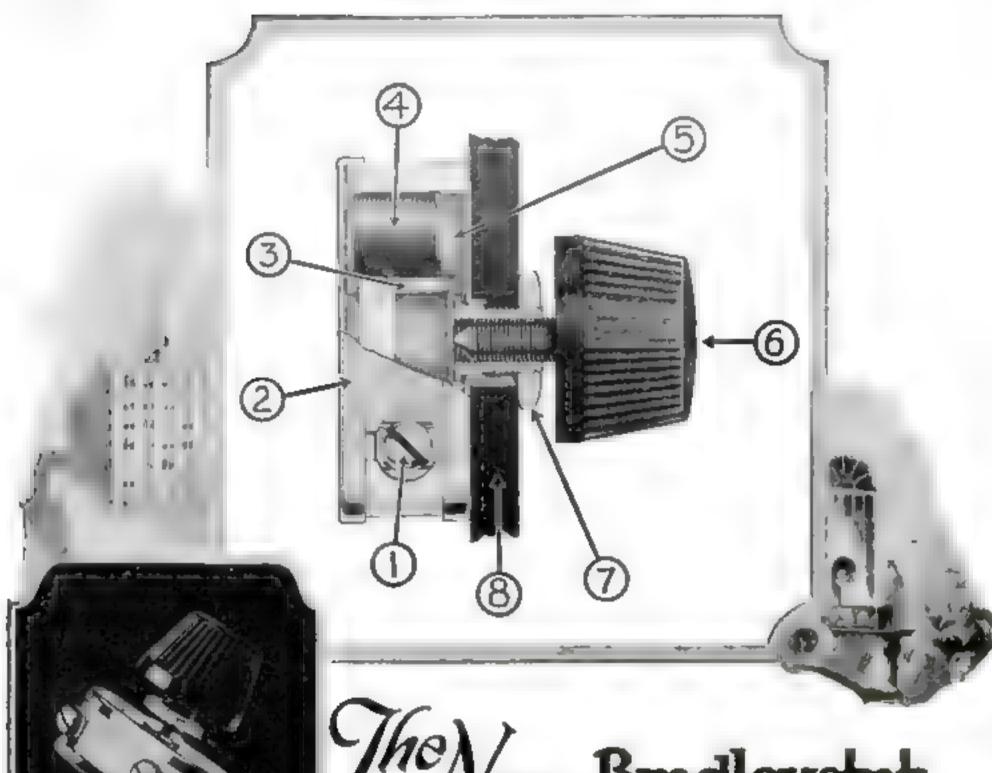
By Dale R. Van Horn

AN ICE merry-go-round will prove to be popular with any ice club or group of skaters. It may be made in two or three hours, if suitable materials are at hand Select a stretch of ice some distance



This unique ier merry-go-round can be set up with very little work or expense

from share where the water is only 2 or 3 ft. deep. Cut a hole through the ice and set a straight pole into the mud. Attach a wheel to the top by means of a holt or lag(Continued on page 131)



Important Features

- 1 Two terminals suffice for ALL Tubes.
- 2 Back-panel extension is 11/16 inch.
- 3 Holes for table mounting are provided,
- 4 Graphite discs give stepless, noiseless control.
- 5 Internal switch opens bettery circuit.
- 6 One knob provides control from 1/4 to 100 ohms.
- 7 One locknut holds Bradleystat securely in position.
- 8 Drill only one hole in panel.



The Vow Bradleystat

Supreme in design and performance

ASIDE from the novel "one-hole mounting" that characterizes the Allen-Bradley line of radio devices, the most striking new feature is the extreme compactness of the graphite disc container. When mounted on panel, the new Bradleystat extends less than three-quarters of an inch behind the panel. The same is true of the Bradleyleak and the Bradleyohm. And the Bradleyometer extends only seven-eighths of an inch.

You can improve your radio set immensely by substituting a Bradleystat for your present wire rheostat or a Bradleyleak for your old grid leak. There's plenty of room, Try it!

Allen-Bradley Co.

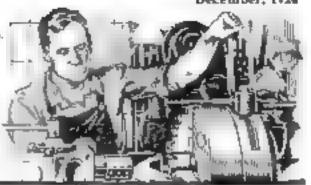
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Better Shop Methods

How Expert Mechanics Save Time and Labor



Old Bill Repairs an Engine

By James Ellis Machine-Shop Superintendent

T SEEMED that everything was wrong that morning. The big bees

had promsed certain dehyery on a rush job, and now a huge easting that was an important part of it was missing! In fact, there were two castings. One was in the machineshop, but the other was still pig iron.

Old Bill alwayshad enough to do to keep the maching-shop running smoothly without bothering about the foundry, but

this time he hied himself out to see what the matter was.

"Cau.dn't melt enough Iron to make both castings the same day," the foundry foremun explaine

Old Bill reminded him that he had made two like that before; inneed, had made three.

"Well, the old cupear won't melt like it used to," said the foundryman. "It's been getting worse all the time. I don't believe that we have as much draft as we pught to have."

Old B L did not like explanations, what he wanted were results. He went out to the foundry again that afternoon and looked around. He saw what was wrong. The fan was not running up to speed, and

of course it was not giving the proper binst. He went over to the engine, and a trained ear told him what the trouble was.

"Have to fix up that old gal," he mused, and went to tell the foundry foreman what he was going to do.

First thing the next morning two of Old Bill's boys were taking the engine to pieces. It was not a large one, about 8 by 11. He watched to be sure that enough marks were put on to certain everything MARIO ... would go back property

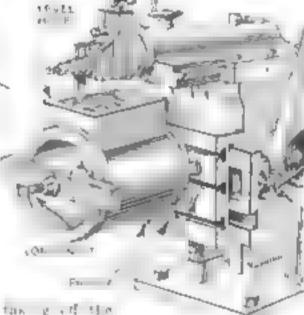
As soon as the puston came out, Old Bill gave a grunt.

"It's a shame the way these ron melters treat machinery,"

he burst out. "They don't know how to take care of anything! I wonder if they know there is such a thing as oil?"

It did look bad. The rod was scored and cut, and one of the rings was broken.

> Old Bull ex prairie The trick of ber ng an mane of ture (rut abusers June ta up the sat on t a disper-



15 - 105 65 e in passed his hand in and left a groove, so he ga enters for the end on to be taken off to . He sent the piston to the shop to have a new made while he was at I tak got the cyannius

"Be sure and leave enough so that we can fit it after the cylinder is rebored " he captioned. "Jack, you take the cylinder in to that 24-in, lathe by the door and bore it, and don't lose any time, for we shall have to face the valve seat before we put it back."

He looked at the brasses, and sent them in to another machinist. He was satusfied with the crankshaft and with the guides, but decided to true up the valve stem.

He had started to the machine-shop and was about halfway there when he met Jack coming for him

"This cylinder won't swing in the 24-inch fathe," said Jack "I shall have to wait until I can get the 30-inch machine."

Old Bill laughed a little.

"I don't want you to swing it, sonny," he said. "We can do a better job if we d or I swing it at all "

Jack seemed to be perplexed, but he followed Old B h toward the lather

' Pick up some of those bars there: we may need thom," Old Bill said, so they passed a box where long bolts, clamps, and various kinds of blocks were kept.

> "Now then. run the crossalide off the back, for we want to get that out of the way," Old Bill awd, "Get the cylinder up on the carriage and I'd be back."

> It was some minutes before returned, and the cylinder casting was lying on the carriage funt about where he wanted it. He was carrying a

piece of shafting about 8 in. in diameter and 4 ft. long. A helper was following with what appeared to be an old shaft coupling

Old Bill put his piece of shafting through the hole in the cylinder and swung it on the centers. He took his rule out and measured the distance from the top of the bur to the top of the cylinder

> bors, and from the bottom of the bar to the bottom of the bore. He did a little mental writhmetic.

> "Now raise the casting about 2 '2 inches," he said.

> By this time the boys had a pretty clear idea of what he wanted to do, so it was no time before the cylinder was raised the required amount, the coupling casting mounted on the bar, and the har put back between the centers. The coupling had a slot to bt a toolbit, and a clamp to hold it in place. A tool was put in this slot and swung around one end of the cylinder. The

(Continued on page 110)



WHEN you have founded with a machine. clean it up and leave it in a presentable condition. Let's hope the next man who uses it will do the same

Accidents are always unexpected. Be careful

If a machinist knows what he is doing. you can tell it by the way he tackles a job Without patience no mechanic can hope to get very far, it a one virtue he must have

It's less embarrassing to ask questions than to spoil a job Suppose you were asked to inspect and pass on your own work what kind of an inspection ticket could you make out?

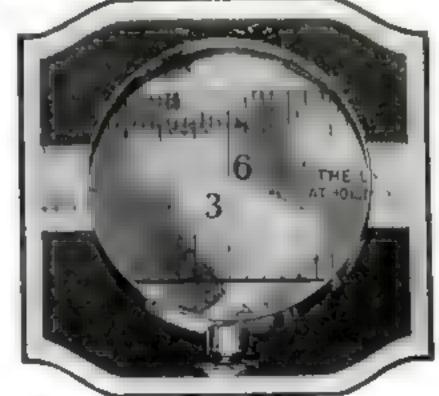
The cutting speed for any kind of metal-cutting tool is limited only by the ability of the tool to resent the heat, atrain, and pressure of the cut without burning or breaking.



BILL'S got another new rule, I see. He sure does rust 'em out."

"Not any more—that rule is the same one he's been using for the last two years. It always looks like that—it's a Starrett Stainless."

RUST PROOF



Starrett Stainless Steel Rules laugh at moisture, perspiration and certain acid fumes that soon destroy the usefulness of the ordinary rule. They are made from a fine quality non-rusting, non-staining steel. No. 1000 (hardened and tempered) is made in 6 and 12 inch lengths. No. 1020 (flex-lible) supplied in 6 inch length only. Like all Starrett Rules, the Stainless is graduated with extreme accuracy—a reading glass proves that even when magnified the division lines show up sharp and clean-cut—perfect in every way. Use Starrett Rules for closer and easier work.

FREE REFERENCE TABLES World's Greatest To

Wire Gauge Standards, Decimal Equivalents, Allowences for Fits, Tap Drill Sizes, Color Chart for use in Tempering, Lubricants for Cutting Tools, Drill Speeds, Double Depth of Threads, Metric Conversion Tables Miscellaneous Measurements, Tables for Computing Weight of Cast Steel.

All this and other valuable information needed by every look-user will be found in the back of the NEW STARRETT CATALOG. Mailed FREE, Write for No. 23 W

THE L. S. STARRETT CO.

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Starrett Tools.

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I Added These NEW

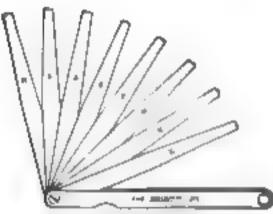
Brown & Sharpe TOOLS To My Kit





No. 577-Throad Tool Gauge

"The Brown & Sharpe Thread Tool Gauge is adjustable and checks any thread cutting tool from a sharp V to a one inch flat within a given angle, It eliminates my keeping a variety of slot gauges on hand for all the different pitches."



No. 648 - Thickness Gauge

"I needed a thickness gauge with long blades and one that I knew was accurate, so I chose a Brown and Sharpe Thickness Gauge No. 649 because the 6-in. bindes are accurately ground to size."



No. 825-Planer and Shaper Gauge

"My Brown & Sharpe Planer and Shaper Gauge No. 625, saves me much time. It is quickly set with a Micrometer, Vernier or Caliper and then the planer cutting tool is accurately set to the gauge."

Learn more about these and other new and useful Brown & Sharpe Tools by sending for a copy of the No. 29 Small Tool Catalog, which is yours for the asking. Write for a copy today.

> Brown & Sharpe Mfg. Co. Providence, R. I., U. S. A.

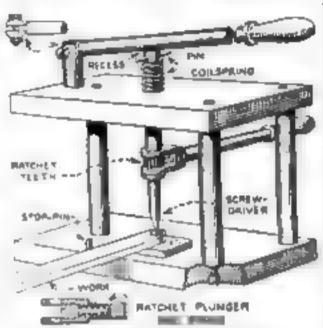
Brown & Sharpe Tools

"Standard of the Mechanical World"

Ratchet Fixture for Driving Machine Screws Tightly

THE work of assembling the parts of small machines and other mechanisms in large quantities, when many small screws must be handled, can be speeded up by the use of special fixtures for driving the acrews in place. Usually a simple fixture for this class of work can be made at small cost, yet it may cut in half the time required by hand methods.

The construction of a screw-driving fixture I have been using on a difficult job is



The acrewdriver bit is held down with one lever and turned with the other

shown clearly in the accompanying illustration. Pieces to be assembled are placed on the base plate with the screw inserted in its hole and the screw is brought in line with the screwdriver bit,

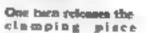
Bearing down on the upper handle holds the hit solidly in the screw slot. The screw then is driven rapidly home with the ratchet handle. When the upper handle is released, the collspring at the top raises the spindle in position for the next screw -F J W

Quick-Acting Jig for Drilling Holes in Round Stock

RILLING transverse holes through round-har stock or pipe usually necessitates setting up a V-block on the table of the drill and some form of top plate with a guide bushing.

One of the simplest ways of handling such work is with a combined block and

ing, as Illustrated. A clamping piece is made and drilled to accommodate the apecial. Various block, sizes of drill guide bushings thus can be used in the one holder. A spacing support of pipe goes over the end



With the stock on the drill table and the guide

block in position, tighten the inside bolt to clamp the work. To change parts, one turn of the inside bolt releases the clamp and jig. Much time can be saved with this fixture on repetition work. G. L.



Better than Home Made"



TEN, fifteen, or twenty years ago, home-canned fruits were better than those bought at the grocers. But today, the products of the canners are uniformly better than foods canned at home.

It isn't by chance that today you can buy canned fruits, vegetables, meats and fish that you know even before you open the can—will be delicious.

There is a distinct reason why there has been a big improvement in the quality of all canned goods. It is the exact control of heating processes. From Temperature Controlling, Recording and Regulating Instruments—the Sixth Sense of Industry—makes possible the production on a large scale of cooked products of an absolutely uniform quality.

By using Free Thermometers in cooking, women in the home can now get the same uniform results that the big canners get.

Whether you are in the business of canning fruits, vegetables, meats, or other cooked products, or interested only in cooking in the home, there are *Jeos* Temperature Controlling, Recording and Regulating Instruments made to be of specific help to you.

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If your manufacturing problems require the indicating, recording, or controlling of heat, whether you manufacture steel, or pack sardines, there is a type and style of instrument in the **Sea** Line of 8000 varieties that you need.

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Your dealer will show them to you. Ask us. on a postal, for booklets on any of the above,

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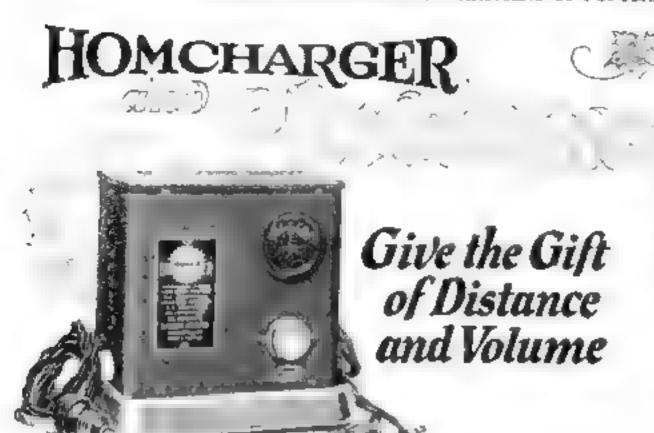


See Sphygmomenameter, Pocket and Office type

For Urinalysis Glessware. Fever Thermometers. Bulletins on request.

ycos Temperature Instruments (
Indicating - Recording - Controlling





YOU can give the most welcome gift of radio-increased distance and volume. This is the gift to be used and cherished for years to come.

The New Silent

Anyone who can operate a radio set can use the new Bilent GOLD SEAL HOMENARORS.

More than 200,000 satisfied users of the Homekanuka are doing this to-day. Give your family, your friends, everybody, the gift of better radio, resulting from the great advantages of storage battery tubes.

So "Christmasay"! Finished in handsome bright mahogany-red and gold, the new silent Gold Shall Hou-CHARGER makes a happy, brilliant display de luxe. It has rubber feet, too, and can't mar polished tables or floors.

FREE! Get the interesting booklet, "The Secret. of Distance and Volume in Radio," containing valuable information on radio at its best, and fully describing the new eilent Gold Stal Homehander. Your dealer has it; if not, send us his name and we will mail you s copy post-paid.

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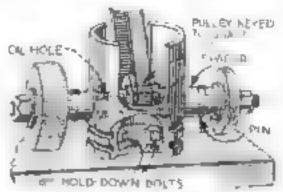
or liquid types of charger

- n_are the battery 5-Clean no bulls to break no liquids to spill or produce fames.
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Piston Used as Stand for Small Bench Grinder

FIRST class belt-driven grinding stand can be made from a discarded piston. Obtain a piston with fairly good bronse wristpin bearings and saw away a portion of the piston skirt, as shown, so that the belt will have no interference

From a piece of cold rolled steel or an old axls, turn the wheel shaft to fit the bearings and thread at each and. If the bearings are not a standard size, it will be necessary to turn the abuit at the section where the wheels will be mounted to one



The broade wristpin bearings of a discurded piston support the grinder spindle

of the standard wheel fit sizes, which generally run in even eighths up to an inch-

Spacers are used on each side of the piston to hold the wheels the proper distance away and also on each side of the pulley The pulley may be any convenient diameter and abould be keyed or otherwise fastened to the shaft. Oil holes should be drilled and the piston boited to the bench before the shaft is assembled.

It is advisable to pin the two outside spacers to the shaft with taper pine so that when the wheel nuts are drawn up there will be no undue binding,-W. F. SANDMANN, Indianapola, Ind.

Lubricating the Cutter on a Vertical Milling Machine

TERTICAL milling machines not always are equipped with an oil tank To supply oil to the cutter in such a case, I have used the method shown with success and pass it along to others who still may be using a squirt can or brush

An ordinary somp can, fitted with a



For millers without on oil tank

wire bath, is bung from any convement location or projection above the cutter. A piece of soft brase or copper wire of suitable length is doubled back on itself and twisted locaely One and is wrapped with a piece of cotton waste and bent to hang over the rim of the can, nearly touching the bot-

tom. The other and is left forked and bent around the shank of the cutter to allow the wire to ride off the shoulder. The can is filled with oil and the waste is well soaked. In a very few minutes the oil will start to flow and keep the mill well supplied. H. W.



THIS BATTERY WILL MATERIALLY REDUCE YOUR OPERATING COSTS ON HEAVY CURRENT SETS

NEW!

Everendy Beavy Duty "B" Battery, 45 volts, Three Palmo-ting t close. Langth, 8 3 16 inches, waith, 4 7 16 inches, beight, 7 3/16 inches, weight, 1316 pounds.

Price \$4.75

Stands up to heavy duty

THE new Eveready 45-volt heavy duty "B" Battery (No. 770) is made to stand up and deliver the large plate current required by multi-tube receiving sets. Extra large powerful cells, packed with the famous Eveready vim and vigor, give longer life on severe service. For "B" Battery economy use the Eveready 45-volt "B" Battery No. 770 on receiving sets using four or more tubes and operating at 90 volts or more, and all power amplifiers. There is an Eveready Radio Battery for every radio use. Buy them from your dealer.

Manufactured and guaranteed by NATIONAL CARBON COMPANY, Ixc. Headquarters for Radio Battery Information New York San Francisco

Canadian National Carbon Co., Limited, Toronto, Ont.

Radio Batteries

-they last longer



Price 65.73









Make yourself a present of this milling machine

JUST the thing that every amateur mechanic and owner of a small workshop longs for.

Has a three-step cone pulley, 115, 215, and 315 inches in diameter, for 1-inch driving belt. Live spindle has cone bearing to take up wear.

The table measures 11 1/2 x 33/8 inches and can be fed three ways by hand wheels. Feed screws have graduations for fine adjustment. Knee is elevated by a screw operated by a hand wheel at back of frame. Bench space of pan or bed, 8 x 12 inches.

This machine is furnished complete with a compression chuck with 3/4-inch bushing. Countershaft, arbor, vise or centers may be purchased separately.

Other tools for amateur mechanics

The Goodell-Pratt Catalog No. 15 is a genuine paradise for tool-lovers. In it are shown all the 1500 famous good tools—many of special interest to the man who is building up his own workshop and who is on the lookout for more complete equipment. Catalog No. 15 is free. Write for a copy.

GOODELL-PRATT COMPANY GREENFIELD, MASS., U. S. A.

Toolsmilks

Makers of Mr. Punch

GOODELL-PRATT 1500 GOOD TOOLS

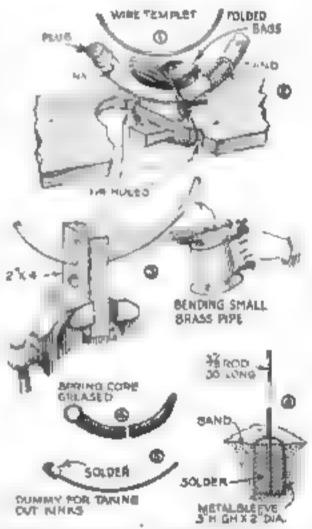
Methods that Aid in Bending Pipe Successfully

By C. F. Waldron

PLUMBERS, pipe-fitters, and electricians frequently are called upon to install a pipe job requiring many bends. To make them neatly, accurately, and quickly is a real test of mechanical skill, especially without a pipe-bending machine or special tools.

The bending of pipe, indeed, should be practised among plumbers and fitters more than it is. The use of bends in place of fittings where possible results in work of nester appearance, a saving in fittings and better results. This is aspecially true in the case of hot-water installations or where circulation is required, on pump suctions to eliminate friction, and on wests lines to lessen the danger of stoppages. Pipe is always weakest at the threaded joints.

Lead pipe from % to % in, may be bent over the knee, and larger diameters also



Bending had pipe to wire templet, bending pipe tubing, and method of making curs and durantee

may be bent this way if the bend is not too short. For short bends a spring, well greased, is sometimes used (Fig. 4), although filling the pipe with sand and plugging the ends will give better results. It is important to have the sand dry and well packed in the pipe. Piug the ends with wooden plugs. When filling the pipe with sand, tap the outside occasionally with a piece of soft wood or a wooden mallet to shake the sand down

In making bends over the knee on pipe 1 in, and larger, a bug or piece of heavy cloth should be used as a pad to prevent kinking.

If the required bend is difficult to measure, make a wire templet, bending it to the radius wanted as shown in Fig. 1. Before making the bend, always dress the sides

(Continued on page 106)

SANTA CLAUS, THEY'RE HERE! THEIR FIRST CHRISTMAS TOGETHER



Oversian Decicled Pan \$7 - New "But Bro." Decicled Pencil to March \$4-or Standard Stan Decicled Pencil \$3.50

inquiring Reporters"

Settled the Gift Question for You

When they found more people wanted the Parker Pens than any other make

Yes, and a Parker Duofold with 25-year point will make this a 25-year Christmas for those to whom you give it

WHAT they told the "Inquiring Reponers" from 34 newspapers in the answer you would get if you ented your brands and loved ones to name their Christmangifi.

Out of 2024 people picked at modern more named the 'Parket' Pen than any other make when the reporture asked: "What pen will you

And there's no finer guesture of affection than to cond them teigning frequiess instead of trilles that have no purmanent Value.

To the man give the \$7 Over-size Dunfold with the man-size grip, and the entra ink-supply that is just like money in the bank when needed.

To the woman or girl give elender Lady Doolald, \$5. To the boy give Duoloid Jr., \$5.

Duolold pencil to metch any one of the pena, \$3.50. New "Big Bro." Duolold Pencil, \$4, a real

mace for the Over-size Duofold Fux in build and fixush. The first mechanical pencil with a balappeal over-size grip that doesn't crattip or tire, but makes a frame of the hand the instant you grosp it.

Setin-lined Gift Box De Luxe included with Duotold Pen and Pencil sets, called Parket Duotold Dueron.

All Parker Duolold Pens are made in flashing plans black, at well at lacquar-red, black tipped. All have the jewel-smooth Duoloid point that's guaranteed, if not abused, for 25 years' west. All have the same hand-fitting symmetry and balance that ampire writing, and give one's permanship the speed and character that win with the world.

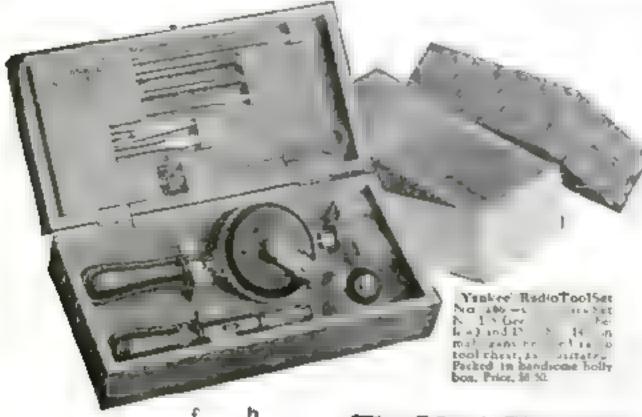
But don't be lace in ordering from the first pest counser -else there may not be time to have your Duoloide engraved with the names of the lucky ones who're to get them.

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Lady Duojold Ribbon \$1 exte

Dunfold Jr.

15 Year P



The Ideal Christmas Gift for the Radio Fan

"YANKEE" Radio Tools

WHAT interests men the most about radio? Tinkering, of course! Building new sets; changing book-ups on old ones; experimenting for better results - that's what men and boys enjoy.

So the gift of "Yankee" Radio Tools is sure to be appreciated.

> "YANKEE" Radio Tool Set No. 105. Price, \$3.25

Set No. 195 comprises "Yankee" Ratchet Tool Holder (a) with "Yankre" Radio Attachmenta sa follows a

Long Screw-driver Blade (h) = for maching into box. berween wites, etc.

Small Screw-driver Blade (c)-far acress on dista esc. Henry Serew-driver Blade (a)-for putting un gerinle, etc.,

Councerstak LD-for alaking heads of screen. Reamer (b) for enlarging holes in panel. Wire Bender (1) - for making loops and turns. Socket Wataches, two shee (d 4) -to cover all

> Ales, Het Wrench, (I) - for square or hen, one end : other end, her for jacks Packed in holly box.

> > "YANKER" Radio Drill No. 1431, Price, \$3.00

No. 1431 is a compact, sowerful perfectly balanced hand drill with four to our grar for speed and special radio chuck. Capacity 9/32 mch.

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Your hardware dealer can supply "YANKER" Radio Tools

Write for Free "YANKEE" Tool Book

NORTH BROS. MFG. Co., Philippin, U. S.A.

TOOLS Make Better mechanics

Tricks in Bending Pipe

(Continued from page 104)

in slightly with a smooth board, as the pipe, even when filled, has a tendency to swell at the sides.

For bending lead pipe from 2 in, up in diameter, two holes bored in a plank or bench will be necessary to hold the pipe. Make these holes about I id in, and approximately 7 in, spart. Place the pipe on the beach or board between the holes, as indicated in Fig. 2, and pass a short piece of rope through the holes and over the pape, tying it on the under side. Then place a bag or pad between the rope and the pipe to prevent kinking. By using the wire templet, the pipe can be marked with chalk where the bend is to start. Roll the wire and mark where the other end terminates.

WHEN ready to make the bond. place the bag underneath the rope and tie it firmly. Always lift the pipenever push down. If the bend is to be short, a wedge may be driven underneath the bench or plank to tighten the rope. Do not try to make the bend in one pull, especially if it is a short one. It is sometimes necessary to reheat several times. trying the templet in each instance and marking where heat is needed.

If the pape swells at any point, it can be dromed in after the sand has been removed and the inside kinks can be dressed out with a "dummy." A good dummy (Fig. 6) can be made from a piece of \$6-in, steel wire about 80 in, long, and an iron eleeve about 2 in. in diameter by 3 in, high. Set the wire upright in the sleeve, pack sand around the sleeve, and fill with solder, as in Fig. 6. Cut off the sleeve and file or resp the solder amouth

Copper pipe may be bent by filling it with sand or rosin. If rosin is used, first anneal the pipe by beating the full length. This is very important as any spot in the pips not annealed would be likely to kink in bending. After the pipe is cool, a pot of rosin is melted and poured into it, or the pipe may be filled with sand.

Copper pipe can be bent cold by using rosin. A wire templet is an ald in making bends accurately and always should be used except in work that does not call for any special exactness.

BENDING block as shown in Fig. 8 or two from pins inserted in a beam will be found very convenient for bending copper pipe. When placing pipe between the pins, always use wooden strips between pipe and pins to prevent kinks. Great care must be taken not to kink copper pipe, as kinks are not easily removed. Dummies or spanking tools for copper pipe are made of iron.

Large copper pipe may be bent by using as a bending block a plate of cast from about 10 in. thick and 4 ft. square with a number of square holes in it. This plate is laid flat and two or three pins with square shank to fit the holes are placed in positions best suited to aid in making the required bend.

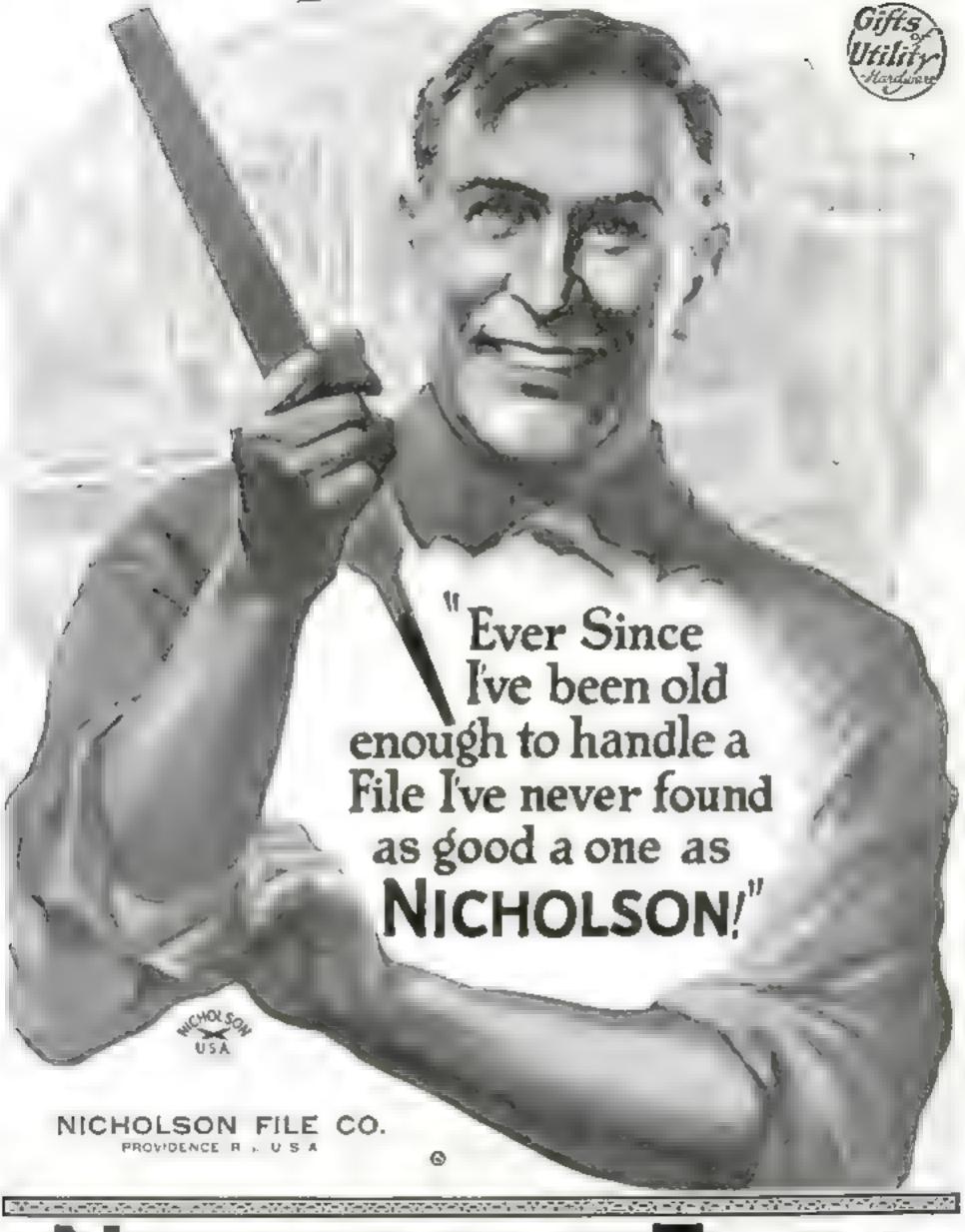
When sand is used for bending copper pape, it is best to heat the pape. If the heat spreads, it may be confined by pouring water on the pipe outside the

(Continued on page 108)

Set No. 105, Price \$3.25

Comprises Yankee Ratchet Too Hulder and a "Yankee" struckments for radio work, as described. Packed in gift box.

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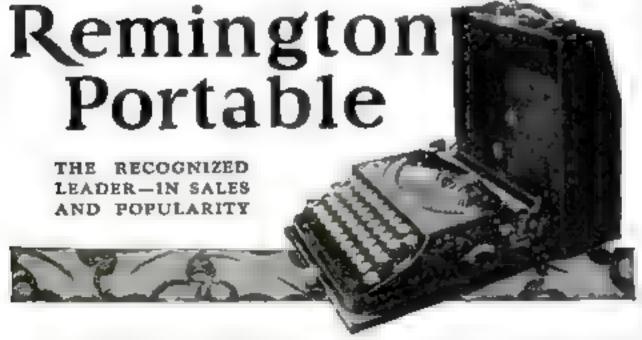
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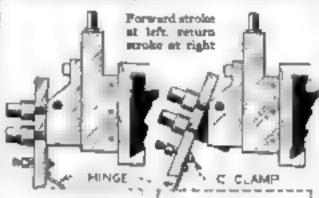
Dept. 67, 374 Broadway, New York



Hinge Raises Planer Tool

THE dragging of a planer tool along the work on its return stroke, especially on a large job, tends to dull the tool edge.

In work of this nature I attach a small, freely acting hinge to the back of the tool



with a C clamp so that one leaf extends somewhat below the cutting edge of the tool. The binge naturally folds out of the way on the forward stroke; but on the return, after the tool has cleared the work, the leaf raises the tool.—J A.

Tricks in Bending Pipe

(Continued from page 106)

guide marks. The bend then is made on the bending block, with a wire templet as a guide. Tarnish and scale left on the pipe after cooling may be removed by swabbing it with muriatic acid.

Bends in brase pips may be accomplished by practically the same methods as for copper. If bress pipe is heated for bending, care should be taken, as brass has a much lower meiting point than copper. If the bend must be held to an exact radius, the pipe should cool slowly so that the contraction will be reduced to a minimum.

In bending small brass pipe up to ¾ in., the best method is to bore a hole in a piece of "two by four" and grip this in the vice-linert the pipe in the hole and apply heat with a blowtorch (Fig. 3 By keeping pressure on the pipe with one hand and playing the torch fiams with the other, the pipe will bend as soon as it is bot enough.

Brass railings usually are made of tubing and the method of bending is about the same as for copper pipe. It is customary to leave the rosin in the tube after bending, to result dents while in service. As brass tubing burns easily, it should be very carefully annealed.

Iron pipe, if heated properly, may be bent without sand, provided the bend is not too short, but it will swell at the sides unless sand or rosin is used. These swells can be removed by squeezing the pipe in a vise before it is cold; it may be necessary, however, to apply more heat.

In making a bend close to a threaded end, always screw on a coupling to protect the thread. For bending a short piece of pips, screw a coupling on one or both ends and use a length of pipe for a lever. The couplings should be poosed with water before bending.

Large pipe that cannot be threaded after the bend is made, must be cut to the exact length before bending. A quick and easy way to get this measurement is to have two wire templets of the bend. Straighten one of them for the measurement and keep the other in shape as a templet.



The More You Know About Radio the Better You Will Like This Socket

If ever a device were designed to increase the efficiency of all receiving sets, it was this new socket by the Master Builder. Radio engineers praise it —new set builders marvel at its ease of instabation and the clear, loud reception obtained that bespeaks the absence of losses—many old-timers have even rewired their sets to establish new distance records and enjoy clearer reception with this better socket.

You'll ke its construction, embodying a minimum of both insulation and metal—capacity absolutely minimized without sacrifice of mechanical strength. And its base of chony Thermoplax in beautiful color contrast with the thin shell of orange Bakelite aids as greatly to the appearance of any set as the construction does to its efficiency.

You'll like its contacts (the source of losses and noise in most sockers); they are radically new in design, formed of phosphor bronze and ulter plated - because the contact resistance of silver does not increase as it stands exposed to air. Then, too, electrical losses are minimized by providing maximum spacing between terminals, both in the insulation and in the air.

You will like the way the tube is inserted and removed without turning—which prevents twisting the bulb from its base. You will like its appearance—its small size—its neatness. You will like its silvered posts with stotted nuts that are fastened well with either screw driver or wrench. You will like the way the terminals are arranged for soldering—extra long so that they may be bent down where under wiring is desired—and provided with ears to hold the wire in place for soldering. And best of all you will like the price, goe. This socket that meets the specifications of the most exacting radio engineer costs no more than most of those on the market today! If your dealer has not yet been stocked, you can be supplied direct from factory at regular price plus toe for packing and postage.

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Perfect contact. Both action of tube prong cleaned when inserted—no contact or west on soulered end,

All metal parts silver pasted perfect contact for the life of the set, Silver may turnish but its contact transfance does not change.

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Convenient terminals for minering—full length to above bending down for under-wring. Earl hold wire in place for soldering

Extra handy binding posts—light connections with eather wrene or acrew driver. Lock washers had terminals right.

Wide spacing of current carrying parts hold in air and insulation—true low-loss construction.

G
A minimum of both metal and throughout for low expacity boel of this Bakedie—the base of genuine Thermoplus.

The tube is held in pace by mercey a vertical motion—no twisting to reparatebulb from base.

The attractive organge shell helps observe this better suchet but the famous C. H. trade much both on the socket and on the orange and blue box is your gramme protection.



RADIO SOCKET



In placing his mark of approval upon. Rauland Lyric, Mr. Maurice Rosenfeld has invested Radio with a new beauty and dignity. His words carry positive assurance, to music-lovers and trained musicians, that they can now admit Radio to their field of appreciation and enjoyment, with the certainty that all voices and instruments will be reproduced with their original and distinctive Tone Quality,

Mr. Rosenfeld, a

The RADIO KEY BOOK contains the clearest arpland-tion ever given of the nature of audin amplification and equally valuable discussion of many other subjects in Rudio. Sent for 10c, coin or ecompaveteran among metropolitan music critics, selected Rauland-Lyric, upon the sole basis of Tone Quality, from a group of the world's best audio transformers.

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ALL AMERICAN

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Old Bill Repairs an Engine

(Continued from page 98)

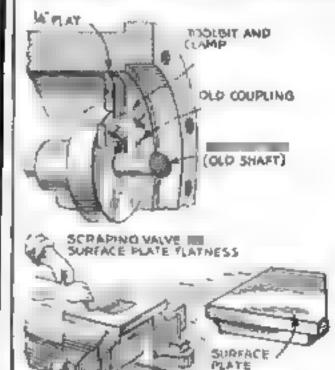
cylinder was raised a little more, using sheet-from shims, and adjusted sidewise so that the tool touched equally on all sides, The other end was centered in the same manner. The first end was checked, and another adjustment made, as it had shifted a little when the second end had been trued up. Presently the cylinder was clamped to Old Bill's actisfaction.

"Always set up a job like this by the counterbore, and not by the worn surface." he said. "If you had used the bore of the cylinder, you would get your new bore out of square with the end of the cylinder, and the piston rod would not travel in a straight line. Now start a roughing out. and let's get the job done."

He was off to look at the other parts. He found the new piston progressing nicely, but the machinist with the brasses seemed to be perplexed.

"I think that we shall have to have new hrusses on the crankpin and," the machinist said.

Old Bill looked at them. They were worn badly, and he saw that they could



fletcing up the boring ber and accuping the valve to surface-plate securacy

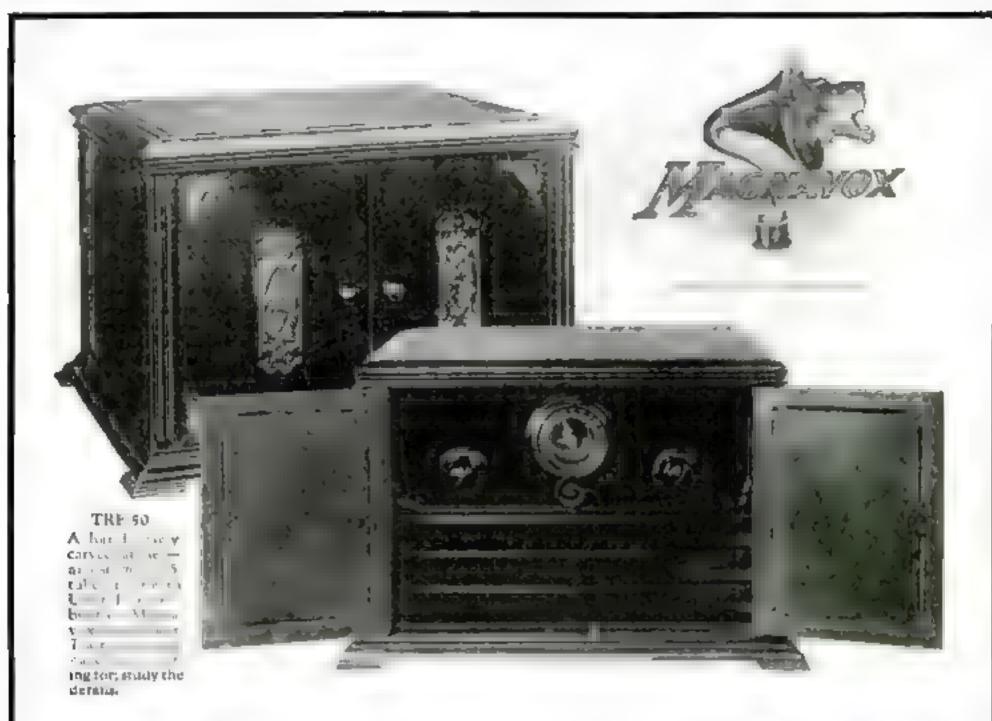
not be closed any more. But to wait for a pattern and castings for new ones would be ton lone.

"We will babbitt the brasses," he sald. "Drill a number of holes up in the sides about 1/2 in. deep to hold the babbitt and then tin them well. Be sure that they are thoroughly clean before you try to tin them. Heat them on a plate over the forge fire hot enough to melt the solder Drop some acid on and rub the solder all over the inside with a stick. Make sure that you get all the spots tinned. Wipe all the loose solder off with some waste while the brans is still hot, and if it shows bright all over, you have done a good job, but if it shows any bram, you will have to work some more."

The machinist seemed to think this more trouble than necessary, especially since he was to put holes in to hold the babbitt, so Old Bill went on to explain

"Unless we can get the babbitt united to the bram, we shall have trouble from hot boxes. The heat that is formed will

Continued on page 112)



MAGNAVOX

Receiving Sets which establish an authoritutive standard of excellence for the daily enjoyment of radio.

TONG identified with the most efficient __ radio reproducing and amplifying equipment, Magnavox has developed its new Receiving Sets under conditions insuring superior design, precision of manufacture, and a gratifyingly low cost.

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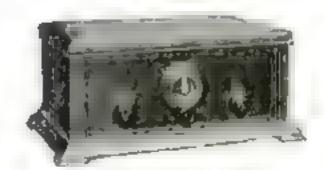
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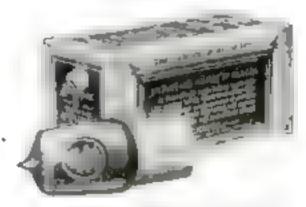
Receiving Sets

111

TRF-50 (as illustrated above)--- is a 5-tube tuned radio frequency repeiver with curved doors and builtin Magnavox Reproducer \$150.00

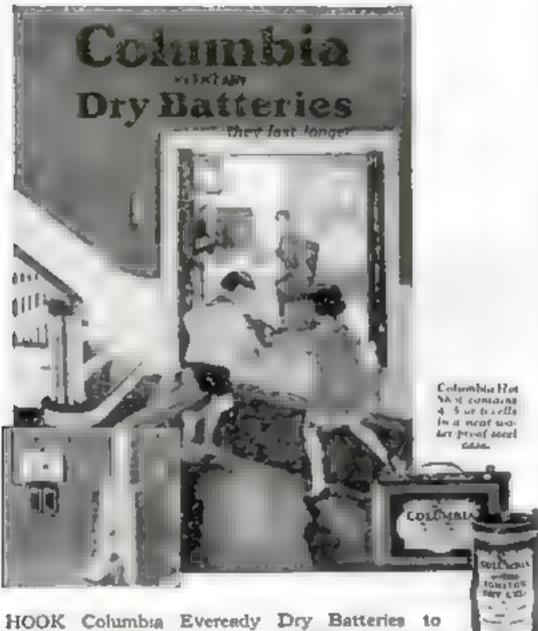


TRF-5 is identical with TRF-50 but encased in smaller cabinet without built-in Reproducer



Type A and Type D-Six-volt storage battery amplifier and detect or tubes with standard base \$5.00

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your heat regulator and stop running up and down stairs all day to tend the fire. A thermostat will tell the batteries your rooms are too cold or too hot-then the powerful Columbia Evercadys will open and close the drafts: these save you thousands of steps.

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and ovebelidean TREDDING SOVE radio "A"

Old Bill Repairs an Engine

(Continued from page 110)

not flow out where it can get away to the air if it has to travel through a layer of scale and dirt. But if the babbitt is what you might call soldered to the brass, the heat will traval through as though it were one piece of metal "

The valve next engaged his attention,

It was progressing nicely

"I want this valve scraped to the surface plate so that we can save time in fitting the seat," Old Bill said. "If you get the valve perfect before you get on the seat, you can save a lot of hard work, as well se time, and we need time, for we can't let the foundry loss more than one day. We shall have to hustle and re-assemble the engine by tomorrow noon. When you get the valve scraped, get the shaper ready to take the cylinder, and we will



Diagram showing method of tinning the bymany and lining them with Bebbitt metal.

POURING THE BRASSES

plane the seat. Be sure that you have tools that will get in all right."

After having attended to some of his other duties Old Bill drifted around to see how the boring of the cylinder was getting along. Jack looked worried. He had taken two cuts through, and had got out all of the worn surface, but it was still rough. There was a chattery place, too.

"I have tried 'most everything I know, and I can't make the old lathe bore smooth," be complained. "It seems like the slower I go and the finer the feed I use, the worse it gets!"

"I'm not surprised," was Old Bill's comment. "You have neglected the first rule on doing smooth work. You have not taken up the slack."

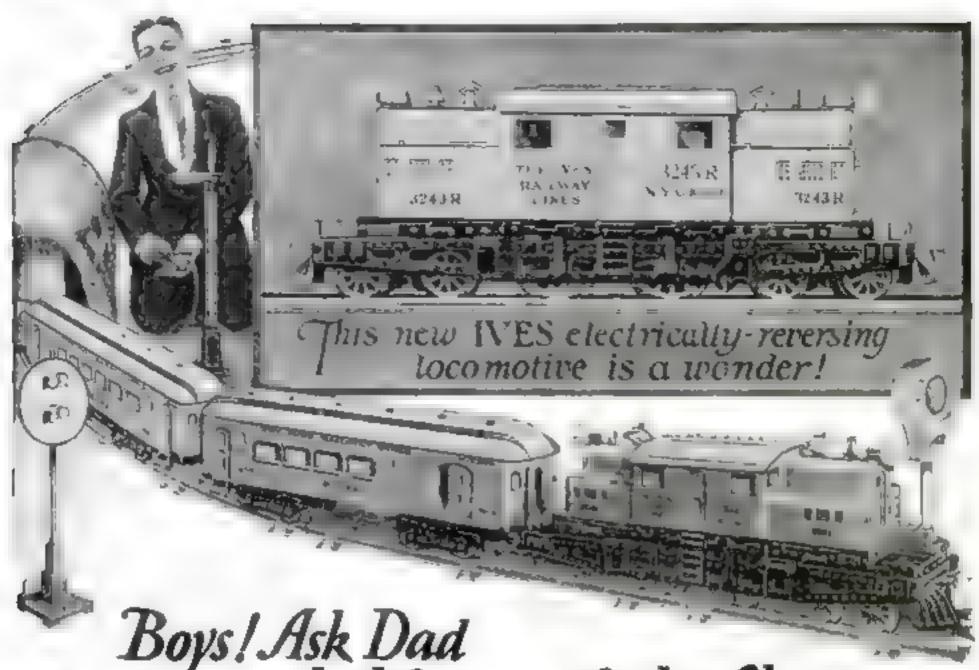
"But I have," Jack retorted. "The center is tight, and the spindle bearing is

tight."

"That may be, but there is a lot of spring in the bar, and you have not taken that out," Old Bill said. "Let's see the tool you are using. Too pointed. Grind it off so that it will be about a quarter of an inch flat, and bring the oilstone with you."

Old Bill tapped the tool out so that it barely touched, and then turned the bar

(Continued on page 114)



Boys! Ask Dad to give you the lifetime gift this Christmas - a wonderful Ives Electric Train

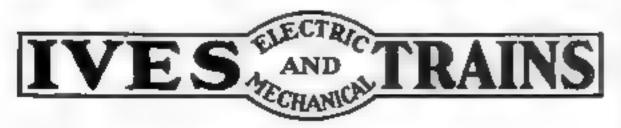
YOU have will experience one of the greatest joys of your life when you see, on Christmas morning a wonderful Ives Electric Revening Locomotive in front of the bright, resolution station. There it stands, wasting for its first run over your newly-established branch of the Ives Rauroad System a system with trackage sufficient to extend from New York to San Francisco, including branch lines all over the country.

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For the first time in the history of American toy-making, a locomotive can be made to reverse, electrically, at will. This operation which, heretofore, could be accomplished only by a mechanical device on the locomotive or track, can now be done by samply working an electric control-switch located away from the track. The revolutionary and exclusive lives reversing feature was invented by prominent Westinghouse engineers and perfected at the laboratories of the Ives Railway Shops.

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All that is in as a line instance in 10 minutes—con arts even a roth of translate and Kernene in place, four-prevent a B and fuel from passing into the cylinders, thus

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Exercises planes the Si Ji uses my i performe a recies to a Ford Distribution and may it performs and its pleased stells has been any everybody buys and its pleased stells has been the main, every order in a RUSH order. To make the testing every order in a security like wildfure. But morely a possible became a trial sells tast after that everybody talky about it apart case or full arms—they all pay will. A trial of the SIPER receipts anyther that they all pay will. A trial of the SIPER receipts anyther the trial of the SIPER receipts anyther the trials. Set to R Boys Trial WERKS SUPER CARRUNCTOR CO.

Old Bill Repairs an Engine

(Continued from page 112)

a trifle. He could see a little dust coming off at one corner of the tool. Old Bill brought the tool out of the hole and rubbed off this corner with the oilstone. He repeated the performance until the tool scraped from one and to the other. Then he tapped the tool out a bit more.

"You will take too much," Jack cau-

tioned.

Old Bill smiled. "Just watch, and I will tell you why," he said.

OLD BILL started the lathe and threw in the feed. He was taking more than a scrape; he was taking about .01 in., and the carriage was moving pretty rapidly, too. Jack looked worried. He knew that

he had had a finer feed on.

"If I were to use an fine a feed as you had," Old Bill explained, "the tool would be dulled before we reached the end of the cut, so I put on a coarse feed to be sure that the tool will be about as keen at the end as at the beginning. That will insure the bore's being the same size from one and to the other. I am taking a heavier cut than you did, so that all the spring and play will be taken up, and we won't have to bother about the weight of the bar. Taking out this much puts the parts under some load, so that all of the spring and give will be alike all around the bors. The tool is honed so that it will leave a smooth and true surface. Feel it."

Jack felt. It was smooth. He had expocted to see big food marks, but there was none, and the tool was curling chips off without any chatter! He watched it, fascinated, until it went out the other end.

"Easy, jan't it?" Old Bill saked, "Now caliper the bore and make sure that it is the same size at both ends, and if it is all right, take it out and truck it over to the shaper that is all ready for it."

Old B.ll presently came over to the shaper. They had the casting hung up on the carriage of the shaper, and were trying

to clamp it in place.

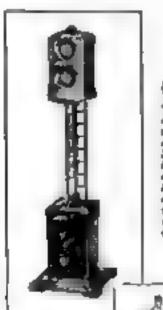
YOU are going to too much trouble, boys," he said. "Put a bolt through the center, and some paper between the surfaces, and that is all that you will need. See if the machine is level crosswise, and if it is, adjust the casting so that it is level crosswise too, and your set-up is made,"

Just then the machinist who was making the new piston came over to get the supe of the cylinder, and Old Bill could see in the distance the babbitt flying from the brases being bored, and he knew that he would have the foundry's engine running in fine shape in time for tomorrow's heat. It was now getting along toward quitting time, so he went toward his office with the feeling of having done a good day's work.

Coming Shop Features

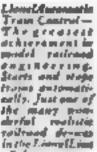
ANOTHER "Old Bill" story by Mr Eliu, "Handling Rush Repair Work Successfully," is scheduled for early publication. Other features include ' Methods and Tools that Have Saved My Time," by E. C. Fellows, and "How to Make the Most of a Drill Press," by F. J. Wilhelm. What a Big Railroad Man

Says about Lionel st- 0.1% had parameter "The Boy who owns a Lionel han dated of all desired to the parties of the part must get all the thrill of operating a real railroad? H. E. Ayram. President of the Chicago, Metworther and M. Paul Railway This is a photograph of the marrelous bossel Mod-Chacona tive referees in Mr. He am lette upon the score is rea of Lounce Montel Care. The complete reason as shown in Quepe 14th.



The greatest schierament in proded parleage ongineering. Starts and stage trains antomationally. Just our of the many prop-derful realistic pollowed desired in the Linnal Lina of Accessories

The Lionel Bell Warning Signal - As the Irain approaches the grade crossing, led automatemic ly rings — stops tinging in soon passed Strel CONSTRUCTION (árrangó sar.



THAT is the statement of a man who knows the latest That is the state of developments in railroading.

He knows, too, that boys always want trains and equipment that are true to life - that not only food like real trains, but operate as real trains do.

For 29 years Lionel has specialized in the manufacture of model electric railroads—not mere "toys". Since 1900 Lionel products have been "Standard of the World". Lionel has always pronected in the development of electric model trains.

The only difference between Lional and real trains is the size.

Take father with you to see Liquel Truns demonstrated. He will get the same thrill out of them that you do. The power, the beauty, the reciness of Lionel Trains and Accessories is enough to delight anybody.

When a fellow buys a Lionel Model Train, Crossing Gate, Signal Tower, Switch, or eay of the many other realistic Lionel milroad devices he knows that he has really got something of permanent and lasting interest and value.

Complete Lionel "O" Gauge Model Ruitrouds are priced as low as \$5.75and a murvelous train for Lionel "Stan-dard" Teack, with illuminated coaches, at \$16.50. (Prices slightly higher in the Far-West.) There are many other complete outfits to suit every purie.

Be sure to see these wonderful trains in your town at department, electric, sporting goods, toy or hardware stores.

Send for this Catalog

And don't full to write for your copy of the wonderful 44 page Lionel Catalog - illustrated throughout in 4 colors. It



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New York City



Lional "Multivolt" Trees. formers. Ever-relable power pleate. Run all trains best. A type for every size tree

MULTIVOLT" TRANSFORMERS

CELORON



"Gee, dad, that's a peach!"

CHRISTMAS morning — and with it gifts that make the radio fan's heart skip a best or two. There we tubes, batteries, a tuning-coil and beside them a beautiful, glossy-black panel. The best part about the panel in that it is a Celoron punel.

Dad used his old bean when he selected a Celoron panel. He picked Celoron because it is a bakelite panel and furnishes the insulation that delicate instruments need to give the best results. He knows that it doesn't pay to skimp in buying a panel.

Celoron has high dielectric strength. and it is practically indestructible. You can drill, tap, saw and bore a Celorop panel without fear of its chipplog or cracking. It is not affected by atmospheric changes, and it never softens, warps or buckles,

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Celoron has been tested and approved by the U. S. Nevy, the U. S. Bignat Corps, by leading radio manufacturers, and by thousands of radio lane all over the country.

Ask your dealer to show you his assortment of Coloron bakelite panels.

CELORON

A Bakelite Panel

Diamond State Fibre Company Bridgeport, Pa., and Chicago, III, Branches In Principal Cities Terrenzo, Canada London, England

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We have prepared two interesting booklets. Getting the Right Flooir up with Celoron, and "Vulcawood the New Cabinet Material," which contain many valuable suggestions for building and operating a radio set Send for your cupies, now. They are

Discussed State Phen Co., Bridgepart, Po. Please send me without charge copies of "Get-ting the Right Mook up with Crioron" and "Vulcawood — the New Cabinet Material." My cutte dutter's name in

See top of page 19 in front

"Buzz Boice" Makes It Easy To Do Hard Jobs

Address.

Hundreds of operations that take leads of time and lots of labor are quickly done with a

BOICE-CRANE Pony Bench Machine

Six machines at the price of one. So compact two need not head, a wathshop. Sund, again, grinds, maters, etcone rabbe a and many attent opens large with easy 400 accurates to 5 P₂ in stack. Ordered by t₂ in 5 to p material action, and light eacher. Write for destriptive catalog of Beach Machines, Band revel





\$4 Awards Offered for Photos of Ingenious Tools

EORGE A. MOHL, a reader of POPULAR SCIENCE MONTHLY, deectibes in the article below an interestmg and ingenious instrument or tool for measuring tregular areas.

If you are a mechanic, no doubt you have made at some time or other an especially useful or unusual tool or fixture to accomplish work that could not he done so easily with your regular tools. The chances are there was nothing on the market you could buy to serve the purpose of the tool you made, and, although it may have given service only un a few occasions, it probably paid for itself many times.

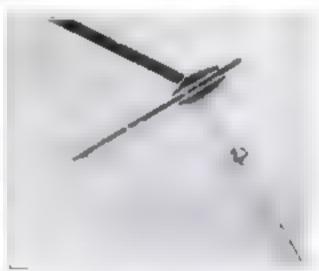
If you have made such a tool, send a clear photograph of it, with a brief description of its construction and purpose, to the Editor, Better Shop Methods Department, POPULAR Sci-ENER MONTHLY, 250 Fourth Avenue, York. For each photograph evailable for publication. Portican SCIENCE MONTHLY WILL DAY \$4

Homemade Planimeter Measures Areas of Irregular Figures

TIKE the average engineer or draftsman, I was without a planimeter for measuring the area of irregular figures such as on indicator cards, ground layouts, and engineering drawings.

"Why can't I make one?" I asked my-

The homemade planimeter illustrated was the result. It cost very little except the time and labor in making it, and yet



As the tracing arm follows the outline, the movable wheel automatically indicates the grea-

it gives results correct to within one per cent of the exact area

The instrument is made mostly of wood. The measuring rod, however, is s thermometer tube with graduations spaced \(in. upart. Upon this rod u steel roller revolves and slides freely.

In use, one arm is pivoted to the drawing-board and the other arm is used to trace the outline of the figure that is to be measured. When the tracing point has passed around the outline, the roller gives a correct read og in square inches.

GEORGE A MOHL, Buffalo, N 1

THE Editor of the Better Shap Methhear from any readers who are interested in making a planimeter of this type and who would like to obtain working details and a full description.

Table-Talker





THERE'S no gift like a watch, nothing used so much, consulted so often, carried so long.

The New Yankee \$1.75

Dependable, as always, but with many new features of grace and beauty. With Radiolite dial, \$2.75.





Waterbury \$5.50

A jeweled watch for \$5.50. 12-stze; nickel case. Combines staming with style. With "silver" luminous dial, \$6.50



Reliance Gold-Filled 811 00

The 7-jewel thin model Renance in a green or white 14-kt gold-filled case,



Essyto Draw Cartoons

When Shown in the MIGHT WAY

Some of the eleverest cartovoists and covate artists learned how as draw in their space done by following Cartovonist Evens: Symple and Easy to Learn Method and are now MAKING (TWY) MONEY. Send one of your drawings, and let Mr. Evans see if you have ability and receive the Partiolio of Cartovons and full decade about the course, it to not expensive.

THE W. L. EVANS SCHOOL OF CARTOGRING MI Laube Building

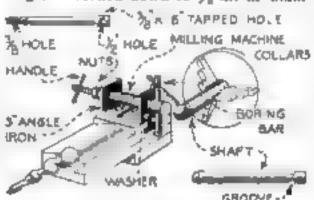


Oulckly Assembled Fixture for Turning Balls

IN TURNING balls on the ends of a number of small shafts recently, where no great accuracy was required, I used the fixture illustrated

Into 2 pieces of 1/2 by 3 by 8 in angle iron a 34 in. hole was drilled and reamed the exact height of the lathe centers. Then the pieces were bolted to the toolpost holder.

A piece of 1-in, cold-rolled steel 9 in long was turned down to 1/4 in, in diam-



When properly set up, this device turns hall ends on rods with fair accuracy

eter for 8 in. The 34-in, end was threaded for about 2 in. to take two 36-in. jam nutu.

A 14-in, hole was drilled through the 1-in. end of this piece to take a round boring bar. At right angles to this hole a hole was drilled for a 1/2-in, setscrew. Another Ja-in, hole was drilled through the threaded end to take a handle.

Several 14-in. milling-machine collers were slipped on the shaft between the angle plates to act as spacers, and the angle from were bolted to the toolpost holder. The two nuts then were tightened.

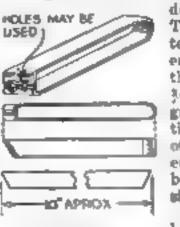
A groove was first turned in each of the shalts to the required depth. Then the ball ends were turned to the proper radius with the special fixture.

The adjustment for the radius is obtained by raising or lowering the horing har or toolbit. When once the tool is properly set, turning the handle is all that is necessary to machine a bull,-J.A.

Tool for Removing Insulation Made from Hacksaw Blade

AN OLD muchine hacksaw blade may be made into a time-saving tool for stripping insulation from wires

Cut the blade to a length of about 10 in., making the cuts at an angle of 16 or 20



For stripping insulation speedily

degrees, as shown. Then grind off the teeth. Heat the ends and bend them up for about Mila. When cool, grind a blent cutting edge on each of the upturned edges, with the bevel on the outnde.

Next, heat the blade in the middie and bend together until the

cutting edges bouch; then restore the temper to the tool. This tool may be left with straight cutting edges or holes may be cut in the sharp edges .- S. W B

AMERICAN PIPE DERBING MACHINE CO.

of for Coto-



OULDN'T it be fun to be able to build a real Pontoon Crane? You can, right now if you have a Meccano Outfit. Think of the fun of making it all yourself and then having it work for you—lifting a load and swinging it just like the real crane in the picture above. And your fun never ends, for with these same parts you can build Signal Towers, Bridges, Automobiles—anything you can think of. You'll be the leader of all the boys.

There's no need to study with Meccano-a book filled with pictures showing just how the

models are put together, comes with your Outfit.

Meccano parts are real engineering parts in miniature—gears, pulleys, couplings, girders, plates, etc., and they are so strongly and accurately made that they all fit together just exactly right. That's why it's dead easy to build with Meccano but you must have

the genuine Meccano. No other toy can do the same —no other toy is just as good. Every Outfit is complete—there is nothing further to buy—the fun begins at once and never ends.



Prices of Meccano Outfits

Vo.	00	(Instructions for 40 models)		\$1.00
10.		(Instructions for 70 models)		2 00
Yo.	11	(Instructions for 106 models)		 3.00
		(Has electric motor)		5 00
		(Instructions for 103 models)		6.00
Vσ.	- 3	(Instructions for 207 models)	1+	9.00
		and up to \$45.00		

There is no limit to the number of models such Ontils can build, in addition in the examples those in the Manual.

---This Book Sent FREE-

Fill in the coupon below, attach the names and addresses of three of year charms and are will send on absolute; free the Meccano by depictured above it is intense y interesting and a beau fully disstrated. Talks all about the joys of Meccano and many pages of models are shown. There are 21 pages of patterns. Send for a today.

ARECANO COMPANY, INC., DEVISION E-2, ELIZABETH, N. 4.
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your dealer can't supply you, we will fill your order direct on receipt of price.

MECCANO COMPANT, lac.

For sale by most department

stores, toy, bardware and

sporting goods dealers. If

MECCANO

Engineering for Boys

Not all construction tays are Meccane.

Meccano is the original Steel Construction Tay, has the greatest variety of parts and builds the chair models. Insul on the genuine Meccane.

This tabel is on every box.



These are the perforated flar supps reisinated by Mr came. They have below spaced a half-neb apart, so has a bearing or factor my can be made wherever rop sted. They are made of almost steel.

In ex your M

I attach my name and address and those of three of my chums. In exchange please send me your bleecane book.

Div K.A.

My name

Syppet

City

State

Prices Greatly Reduced

Increased production has effected savings in manufacturing costs that we are passing along to the craftsones who use levest.

Every workman can now enjoy the convenience and accuracy of a genuine Sand's Alaminum Level. Once realize the lightneas, permanent dependable accuracy and convenience of the Sand's Alumi-244 num models and you'll never use 6 Glass any other. Alveirum **\$**5.50 Sand's

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Years.

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Aleminous

30" 6 Gless Aluminum \$6,50

All are gentiane Sand a Levels with 4 plumbs, 2 levels, protecting senses, crowned spirit tubes, back enamel bubble markings and built-is accuracy.

Carpenters' Pine Levels

Every piece of wood used for a Sand a Level to air dried on months or more. Ad levels are hance fittabed and tested. Three conts of No. dumble weatherproof paint (Illustrated) 24', 25 , 26', 30' In a raigh finish. 2 Glass, \$1 35 No. 677: 3 Glass, 12" to 20", \$1 25 No #79 -2 Glass. 24" to 30" Brass ends and brase 114-BB top plate with (Chatrated) view hole. G Ban 2 band grips. Fully brass \$1.80 bound, and with torare end plates. 18° to 24" - - \$4.50 26' to 30' - - \$4.75 No. 118-Same as above, plain. 18" to 24" - \$2,25 26" to 30" - \$2,50 At Good Hardware Stores Everywhere, or sunt direct upon receipt of price and your dealer's name and address

SANDS LEVEL

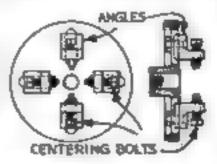
Detroit, Mich.

Lathe Faceplate Converted into a Four-Jaw Chuck

TO MAKE a common lathe faceplate more useful and to save the expense of a scroll chuck when there is not sufficient work to be done to warrant purchasing one, it is possible with very little expense and a small amount of labor to turn a regular faceplate into a jaw chuck.

Four short pieces of angle are required. The size and thickness depend upon the

Jawa made from angle steel ore bolted in the alote of us ordinery faceplate



size of the faceplate. For an 8-in, plate a 1% by 1% by 16 in, angle, cut 1 in. wider than the slots in the faceplate, should be heavy enough

The angle is machined on one side to fit snugly into the fareplate slots. A counterwank hole is drilled into the machined leg of each piece to receive the bolt for fastening the jaw to the faceplate, and a 56-in. hole is drilled and tapped in the other leg for the centering bolt,—F. C.

How to Cut Gage Glasses and Other Glassware

LASS tubes, such as guge glasses, G hottles, and other glassware, can be cut in a number of different ways. The strength of glass lies chiefly in its outside coat; even to scratch this coat lowers its strength. One of the simplest methods of causing a tube to break at a defined place, therefore, is to file it where the break is descred, using a naturated colution of turpentine and camphor as a lubricant

To make the cutting solution for glass, pour the turpentine in a vessel and desolve camphor in it until the solution is saturated, or has taken up as much as it will hold.

Another method is to wrap absorbent paper about the glass, allowing a space of 16 to 8/16 in. where it is desired to cut. Mark this point with a file and using a very small, hot flame from an acetylene torch or similar heater, heat the exposed portion, at the same time moistening the paper with water. During this operation the tube should be supported in such a manner that it can be revolved during heating and both ends protected when the fracture takes place.

The same result may be accomplished by protecting the tube on one side of the proposed fracture with asbeston tape, filing a groove and using a small wire bent to the circumference of the tube, with a projecting end for a handle. Heat this wire red hot, place it on the file mark and revolve it around in the tube to obtain equal heating, and then plunge the tube In cold water

Sharp edges remaining on the tube may be ground off, or a paste of emery powder and water may be spread on a smooth iron plate or a piece of glass and the tube rubbed on this surface. - E. J. MORRISSEY.

Tobacco that says "Merry Christmas" to pipe-Smokers

Each year a number of Edgeworth Club members make a practice of distributing their favorite tobacco among friends as a Christmas remembranca. In some cases Edgeworth happens to be the recipient's "steady" tobacco. In other cases the gift serves as an introduction to Edgeworthin fact, we know of instances where it has

> created a rabid member of the Edgeworth ('lub.

To supply the gift splrit to Edgeworth at Christmas time the makers have provided appro-

> printe wrappings for the 16-ounce glass. humidor jaz and the B ounce tin. Each contains Edgaworth Ready-

Rubbed. Each is packed in a goodlooking decorated gift carton printed in colors. Prices-\$1 65 for the 18-ounce inc. The 8-ounce time are 75c each. Please ask your tobacco dealer for the Edgeworth Christmas packages. If he will not supply you, we gladly offer the following service to you

wedy Kultberg

Send us \$1.65 for each 16-ounce jar, and 75c for each 5-ounce tin to be shipped. also a list of the names and addresses of those you wish to remember, together with your personal greeting card for each

We will gladly attend to sending the Christman Edgeworth to your friends, all delivery charges prepaid.

FOR yourself—It's just possible that you are not personally acquainted with Edgeworth. If that is so, send your name and address to Larus & Brother Company. We shall be glad to send you free samples generous belpings both of Edgeworth Plug Slice and Edgeworth Rendy-Rubbed.

Smoke a few pipelula and judge for yourself wasther or not you wish to become a permanent member of the Edgeworth Club.

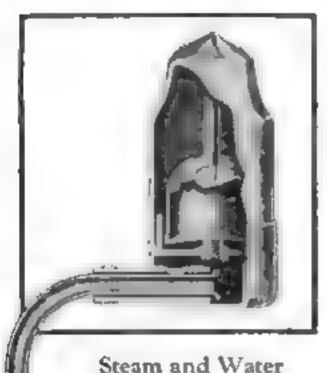
Edgeworth is sold in various sizes to suit the needs and means of all purchasers. Both Edgeworth Plug Slice and Edgeworth Ready-Rubbed are packed in small, pocket-sized packages, in handsome humidors holding a pound, and also in several bandy in-between sizes.

For the free samples, kindly address Larus & Brother Company, 58 South 21st Street, Richmond, Va. If you will also inciude the name and address of your regular tobacco dealer, your courtesy will be appreciated.

To Retail Tobacco Merchanta: If your jobber cannot supply you with Edge-worth, Larus & Brother Company will gladly send you prepaid by parcel post a one or two dozen carton of any sixe of Edgeworth Plug Slice or Edgeworth Ready-Rubbed for the same price you would pay the jobber.

5849 Fischer Ave.,

Heating experts discover how to make cold radiators HOT



cannot pass But the moment that steam file the ratheter and sweets the valve chamber, this wonderfullithe floatexpends

from the heat and closes off the potlet by thrusting a plo up into the venthole, holding it tight shut as long as steam is present. Water, very likely to be present in attent pipes, lifts the float up until the vent is closed by the pin. With AIRID on guard, there is no chance for the radiator to spout like a gayser. An ingenious syphon pipe returns all water to the radiator.

Clever contrivance costs \$1.60 can be installed by anyone

REMARKABLE mechanical device is now being made to get full heat from steam radiators. The secret of it lies in its ability to distinguish between air and steam, or air and water, and to keep the radiator constantly free from air without permitting the escape of the other two elements. Hence the name AIRID, because it rids the radiator of cold air.

The Institute of Thermal Research in Buffalo, N.Y., worked for many years to perfect AIRID. They knew that it must not hiss with escaping steam, nor drip water. They knew that it had to be absolutely automatic and permanently adjusted so that no one could tamper with it.

Rids radiator of cold air

Steam, on coming into a radiator, pushes air shead of it. Unless this air can escape, it forms a barrier beyond which the steam cannot penetrate. Thus it is possible for as much as half the radiator to be literally "choked" with cold air. No wonder steam radiators, equipped with old style air valves, won't get bot!

AIRID rids the radiator of this cold sir. Inside of AIRID'S nickelplaced case, is a little float which may be said to contain the brains. Cold air, propelled by the steam, passes around this float and out through a vent-hole in the top of the valve.

SEND COUPON—attach AIRID yourself

Anyone can make a cold radiator hot by using the coupon below. Airth can be installed by hand in two minutes without tools. Just unscrew the old valve, after turning off the ateam, and insert AIRID into the same hole, acrewing it tight.

Then turn on the steam, and watch AIRID work. The difference

will surprise you. Your radiator becomes hot almost immediately. And the total cost is only \$1.60.



Year after year, AiRiD will go on making your radiator hot. It saves the cost of extra fuel that you might otherwise burn in trying to force the fire for more steam pressure. It saves bills for re-decorating made necessary by escaping steam and dripping water. It saves the wear and tear on nerves, caused by hiss-

ing and sputtering.

Made and guaranteed by

AMERICAN RADIATOR COMPANY

Sold at all heating and plumbing shops

AIR-VALVES

Send this coupon with \$1.60-TODAY

AMERICAN RADIATOR COMPANY Specialites Dept. 1807 Elmwood Ave. Buffalo, N.Y.

I am enclosing \$1,50 for an AiRib Air Valve to make my coldest radiator bot.

Name.

Address.

PEXTO RADIO PLIERS





THIS Plier, drop forged steel, full polished, will form accurately the terminals or loops on Radio Wire and Bus-bar.

One Jaw, as shown in illustration, is of double barrel construction having two diameters for forming loops to slip over 6-32 and 8-32 screws.

It is also equipped with wire cutter.



Radio Socket Wrench No.1

For use on Radio and Electrical accombly



SFT consum of handle and five interchangeable sockets, four for

Hex Nutu, sizes 1 4", 5 12", 51 12", 5/1", and one for Knurled Nuts.

Each set packed in individual box.

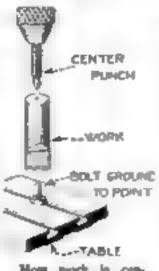
Write for leaffer on Worth While Tools for Radio work.

PEXTO TOOLS are carried by practically all progressies dealers.

The Peck, Stow & Wilcox Co. Southington.Conn.USA.

Drilling Long Holes through Rods and Small Stock

IN DRILLING holes through stock of small diameter, I find the method of drilling from both ends saves much time. To do this on the drill press, a short bolt



How work in cen-

is ground to a point and fastened to the drill-press table. A center punch held in the drill chuck is used to bring the spindle in line with this point.

After the pieces have been centered on both unds, they are drilled halfway through and then turned over and drilled from the other and. The piece rosts on the

lower center and is held with a wrench or small lathe dog. The same method is also used in drilling on a lathe.—
P. J. Wilhelm, Cincinnati, Ohio.

Wire Rack Keeps Blueprints Flat and Accessible

ON CONSTRUCTION jobs where frequent reference to drawings is necessary, it is awkward to handle the blue-prints if they are kept rolled up, as is the usual custom. They also are torn or misplaced easily. One contractor has found the simple arrangement shows below to



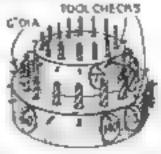
Any hiseprint in the set may be pulled out for reference or removed entirely

be of great value as a time-saver and in keeping the prints in good condition.

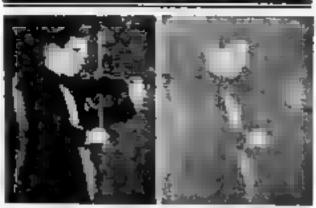
Wire is used to form a rack by stretching it across the workroom as shown. Each print is nailed between two thin, narrow strips of wood. By means of wire hooks attached to the wooden strips, the prints are hung over the wires. Instead of the slats, patent clothespins may be used—8. H SAMUELS, Oakland, Calif

Keeping Track of Small Drills in the Toolcrib

A HANDY drill block for the toolerib, which makes it easy to keep account of the drills, can be made from a hardwood block. It is turned as shown



and drilled to receive the various drills. Opposite each drill hole is placed a small nail or book for the workman's tool check. This drill block saves both time and drills.



Clear, distinct, complete. Elected, indutinot, hazy

Clearness

VS.

Indistinctness

THERE is no reason why the wonderful music now being broadcast should not come to you clear, distinct, and mellow—unstead of blurred, industinct, or crude.

N & K gives you a means of hearing broadcast music and speeches just as the musician and speaker deliver them. Nothing is lost. Every tone, high and low, is clear and natural.

The Resson for This New Clearness

in H h E Imported Phones, Loudspeaker and Phonograph Unit practically every detail of displuragin, sound chamber, proport one magnet construction and winding is original and different. Everywhere has lead-that been broken away from.

That is why N & N Phones are clearer to her tened, more confortable than head eats designed when radio meant only the sputter of a space

That is why the N & N Loudspeaker is different in shape appearance and acoustic construction and is made of a new material, buries, which aliminates counter vibrations.

That is why the N P R Phonograph Unit atterbrd to any good phonograph, makes a loudspeaker of highest type.

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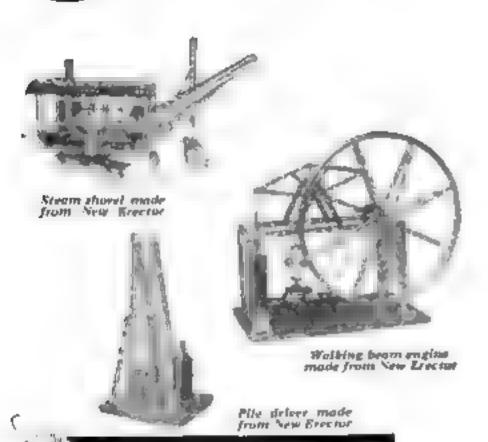


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Genra, Drum Recentric Crimics, Flanged
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NEW Erector has many new features thin year. Some of them are a attain above that digs sand and dumps its contents, a dredge bucket or clant digger, coal loader that unloads a car and loads it in a truck, boilers, to make models of steam engines and curved guders to make round models as well as rectangular ones. These parts are all additions to the standard Erector parts known for years, including the sturdy square girder which can only be built with Erector and the powerful Erector electric motor to run models.

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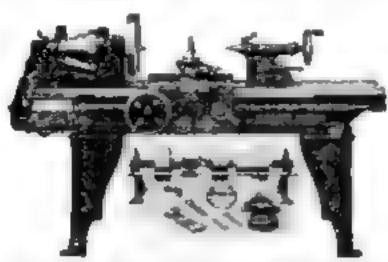
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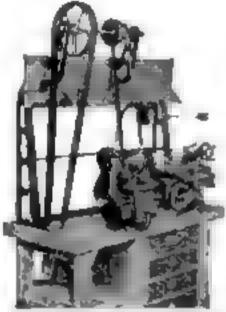




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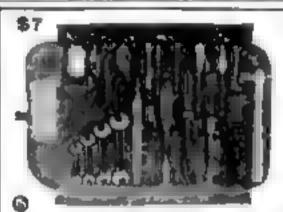
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Spacing Rod Simplifies Work of Drilling Die Cores

LE-MAKERS well know that drilling out the core of a die is a tedious oper-Unless the holes are drilled close together, the core will not come out ensily. In drilling these small holes it is a common occurrence to have the drill run into the hole next to it, sometimes breaking the drill or leaving the hole partly

drilled.



Drilling a die

A simple kink I have been using for a number of years overcomes this difficulty and allows the holes to be drilled closely together. Take a piece of steel the size of the drill and bend it as shown

so that the short and will drop into the first hole when the long end is in the second hole,

To start with, drill the first two holes in the usual way, and after that use the bent rod. The long pin prevents the drill from running into the hole next to it, the drilling is done in this way, the core may be removed easily by tapping it with a hammer.—CHARLES KUGLER, Philadelphia, Pa.

Spring Winding Lathe Tool

"HIS apring winder is easily made and does not take up much room in a toolchest. It is simply a piece of flat steel with a Vshaped cut in one end and a I-in. plug fastened na shown at right.



Winding a spring

The plug is provided with a hole through which the wire is threaded and another hole is drilled for the same purpose at an angle near the handle. The wooden handle may be borrowed from a file that is not in use.

Protecting Hose Lines

FIRE hose used in a manufacturing A plant for washing certain material from a pit was abraded by the edge of a manhole through which it had to be



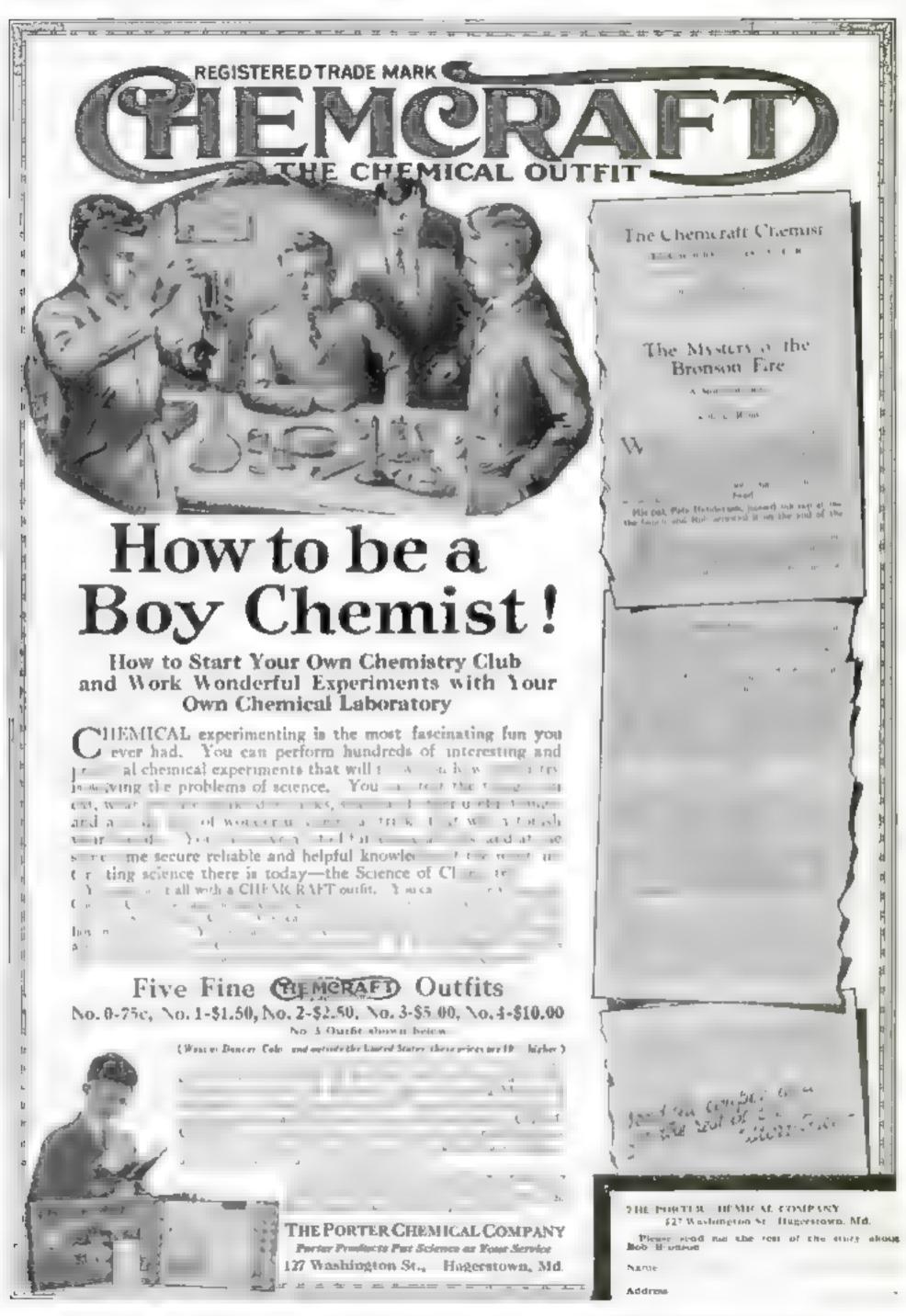
Prevents abrasion

bassed. This wear was obviated by alipping a section of automobile tire about 18 in, long over the hose at the point where it passed over the manhole edge.

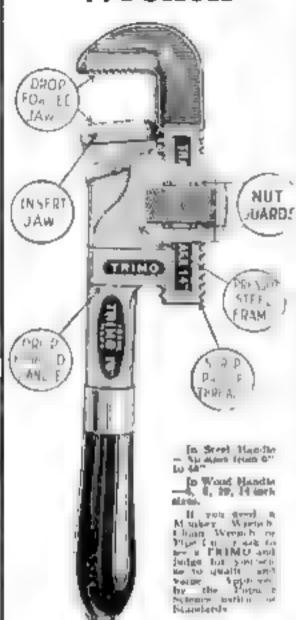
The same idea may be used for

a lawn or garden hose by placing a piece of breycle tire at the point where the hose passes around a corner of the house or over a wall or window-sill.—S. B.

A shor talk on Grinding Methods, by H. L. Wheeler, will appear in an early locue.



You Need This All-Purpose Wrench



Here's one tool that every man who been things ought to have in his personal kit. It's an necessary 'round the house, car, or farm as sciences to a backer.

Be sure you get a TRIMO. Its siveral superior features of design, in dicated in the above illustration, are your assurance that it will tackle the toughest jobs and do them better and casier than any other wrench. And it's by far the cheapest wrench you can buy in the long run because insert jaw as well as all other parts are replaceable when worn and can be obtained at small cost at any hardware store.

The pipe wrench approved by the Popular Science Institute of Standards—a wrench that you'll be proud to own. Your dealer has it in all sizes Input on TRIMO.

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7.5-19

TRIMO

Timing an Auto Ignition System

I GNITION timing, and engine timing, as mentioned last month, are two distinct

operations. Ignition timing refers to the proper setting of the contact-breaker arrangement (commutator or timer in the case of the Ford), while engine timing, which was discussed last month, refers to the opening and closing of the valves.

In valve timing, work is done with the piston in cylinder No. I on the end of the exhaust stroke, the exhaust valve just closing and the intake valve just opening. One complete turn of the engine crankshaft and flywheel will bring piston No. I up top dead center again; but this is the compression stroke. It is the one used for timing the spark to the engine.

The reader is familiar with the fourstroke cycle of the four-cycle engine.

First comes intake on the first down stroke of the piston; the gas drawn in then is compressed on the second or up stroke of the piston. At that point (upper dead center compression stroke) the spark occurs and the charge is fired.

The third stroke is the power stroke in which the piston is driven down, and the fourth stroke is the one in which the up-coming platon drives the burned gases before it. Thus have intuke, compression, power, exhaust, in a continuous chain of cycles of four atroken each. These things are mentioned here because it is so easy for the owner to get into the habit of thinking that all that is necessary in

to get piston No. 1 on top dead center and then set the ignition to it. Piston No. 1 must be on top dead center, but on the compression and not on the exhaust stroke.

IRON WIRE

TH' DEND THINGS

WOODEN STA P

SPARK PLUG HOLE

CONTACT WITH

PISTON

WEIGHT OF

In timing ignition, the motorist first should turn the engine over until at the end of the exhaust stroke the exhaust valve closes and the intake valve starts to open. The operation of the valves is watched by noting the action of the valve lifters (remove the cover plate if necessary). One full turn of the crankshaft then will bring the piston to the end of the compression stroke and the engine should be stopped with the piston on exact top dead center

If the cylinder head is off, thus is easy, because the movement of the piston is visible. If the cylinder head is not off the engine, the spack plug should be removed and a wire inserted to rest on the piston top. If the spark plug is set to one side

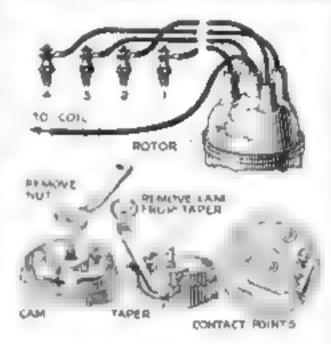
By Ray F. Kuns
Principal, Automotive Trades
School, Cincinnets, Ohio

of the piston, make an indicator such as the one illustrated and insert it in the spark-plug v that the stick is held in

hole to such a way that the stick is held in an upright position and rigid. The pointer then indicates very accurately top dead center. Of course, if the markings on the flywheel for top dead center are known to be right and they are readily accessible, they should be used for top dead center location.

With this most important point carefully located, turn the engine forward until the piston has dropped 1/64 in in the cylinder, or the flywheel has traveled through 5 degrees. Allow the engine to rest in that position and remove the distributor cap. Set the manual control on the steering year so that the lever is in

spark-retarded position.



Methods of adjusting distributor and checking position of parton

Note whether the contact points within the distributor or igniter head have opened or broken, or whether they are about to break. If they are found to be just on the point of opening or ready to open, the setting of the cam should not be changed. If they are not close to their proper position, it will be necessary to loceen. the little screw in the center of the igniter shaft and rame the cam that operates the breaker arm off the tapered and of the shaft so that it is

possible to turn it freely.

Next, bring this cam forward until it is in a position just about to open the contact points and lock it in position by setting the screw back snug. While doing this work, it will be necessary to remove all backlash or lost motion from the igniter shaft by turning the shaft backward (against the direction of rotation) and maintain it in that position

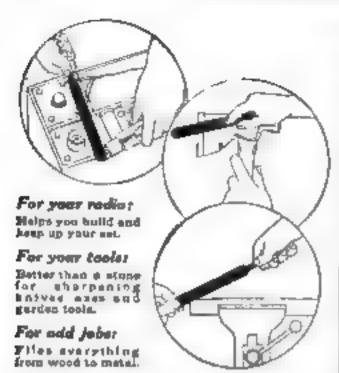
until the cam is locked.

Another point where trouble may be experienced by the car owner is that in getting the igniter to break properly, it is adjusted so that the high-tension spark or jump spark is led to the wrong cylinder. To avoid this mistake, it is always worth while to maintain the aettings just described until the rotor is replaced in the igniter and the distributor cap held in place, when it may be noted whether the outer end of the rotor, with its brass or carbon brush, is under or in contact with the copper segment or point that has a wice running to cylinder No. 1.

If this is correct, the timing is complete and accurate, unless other wires are off the head, in which case it will be necessary to run the successive wires from the distributor head to the successive cylinders of the engine in their firing order.

(Continued on page 128)





With this file you can do any job

ANY man who likes to work with tools needs this new and better file—The Pinmb All-Work File.

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Washing Photographic Prints

WASHING photographic prints so that an element with the "hypo" or flaing so the property of the many presents a professed of a print-washer. A print-washer can be made cheaply, however, by placing a specially prepared hose on the water tap in the lavatory

Obtain a f-in. length of rub-ber home, conting 5 cents, at the drug-store. Fit a cork in one end and make a narrow incision in one side of the hose 114 in. above the cork, as shown.

The hose is slipped over the water faucet in

water faucet in the lavatory bowl, which should be three-quarters ful. of water. The pressure of the water flowing out of the incision in the hose will cause all prints placed in the water to rotate rapidly. The waste water everflows down the drainpipe.

Flow the robber cabe

to this and adjusted

Prints can be washed in an average of 15 minutes, with a saving of a half bour over other methods.—K B. M.

Timing an Ignition System

Continued from page 126;

The beginner cometimes has the idea that the cylinders starting from the first one fire in order. This is never true. A four-cylinder engine may fire 1-8-4-2, or 1-2-4-3, but never 1-2-3-4. Sixen may have a number of firing orders, and this must be learned on occasion. It is usually stamped cearly on the engine.

There are many variations of the above methods, especially with reference to the construction of the igniter. These cannot be given here, but the underlying principle is the same. The apark, when the manual control is in retarded position, must be made to occur. by properly netting the breaker) at a point from 5 to 10 degrees past top dead center, compression stroke, and the spark thus obtained must be led from the distributor head to the proper cylinder, and other and succeeding sparks to their proper cylinders in turn.

Coming Workshop Articles

ON THE Home Workshop schedule for early publication are: Steering Dangers and How to Avoid Them, Circular Picture-Frame; Crafts Hall Table, When Your Faucete Leak; Ornamental Metal Work with Hammer and Shears: Building an Aerial Mest that Requires no Gay Wires: Old Pipe Furnace Converted into an Efficient Pipeless Heater. Recaning Chairs: and Wash Boilet Aids in Building Sporty Racing Sled. How to Construct Attractive Bird House, Turning Off a Gas Water-Heater from a Distance, and How to Cut an Arched Opening in a Partition.



BUILDING AND FLYING AN AEROPLANE

By CHANLES B. HAYWARD. A pine is b. haldbends

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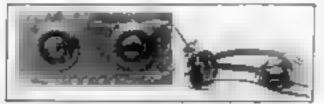
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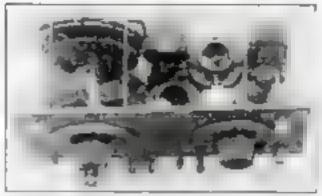
"Built for Service"
The Pitied Lander Co., Secretary, Ohio

Unique Tuning Unit Saves Space in Radio Set By Kenneth M. Swezey

CCASIONALLY a radio receiving set is wanted that is especially compact or one that has adjustments simple enough for a child to manipulate. As there is little latitude for crowding together the detector or amplifier sections, and these parts require few adjustments, the com-



Compact three tube set using special tu



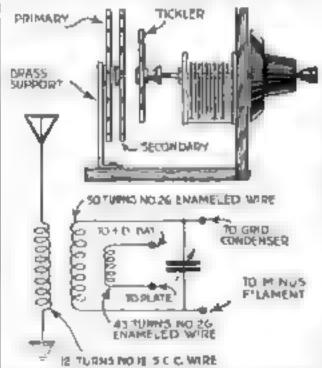
Top view, showing tuning condenses and colle-

pactness and simplicity must be incorporated in the tuning unit

The tuning apparatus Illustrated fills both requirements nicely, is inexpensive,

and is easily constructed.

First, obtain a variable condenser baying a maximum capacity of from .00025 to .0006 mfd. It should be of the type having a single-plate Vernier attachment in the rear that is operated by varying a small knob in the center of the dual. From this the Vernier plates should be removed and in place of the original shaft a longer



Details and wiring diagram of special tuper

one of the same diameter should be provided. This should project back about 1 to In. past the rear bearing

Thread about 1/4 in. of each end of thus shaft, one end for the Vermer knob and the other for a couple of nuts and a spider-web form.

The coil that goes on this shaft is the tickler. It should be wound on a spider-Con inned on page 1 it i

SPECIAL HAND SAW FILES

ically than most other files now being manufactured. Made by the makers of the well-known Simonds Saws and Machine Knives, and backed by an experience of nearly a century in making the finest kind of cutting edges from tempered steel. Made in 51/4", 6" and 7 sizes,

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If you are one of the many readers of POPULAR SCIENCE MONTHLY who find this magazine interesting and useful, who feel that they could not do without it, then we know that you will be glad to tell a few friends that you like "Popular Science" and that you want them to read it too.

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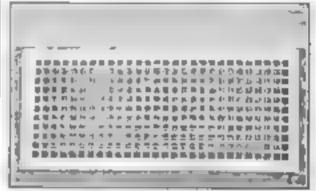
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Wall Grille near Celling Aids Hot-Air Circulation

THE home builder who has located the register for his pipeless furnace in a central hall close to the living-room door often finds the living-room to be the coldest part of the bungalow

The heat rises rapidly to the ceiling into a "pocket" higher than the door opening. Then the heated air floats toward the back of the hall and drifts



A grille between two rooms improves the besting efficiency of a pipelon furnece system

through open doors where no strong current of rising hot air prevents its entrance.

This difficulty may be overcome by installing an ornamental grills of heavy tin enameled to match the woodwork. It is set in the wall between the living-room and hall as near the celling as possible.—A. May Holaday, San José, Calif.

Unique Tuning Unit (Continued from page 129)

web form 3 in, in diameter—43 turns of No. 26 s.c.c. or enameled wire. A nut on the condenser side and a very thin nut on the other side will hold the coll securely to the shaft. Instead of the former rotary motion of the vernier, the new shaft moves in and out.

When this coil is in place, the condenser and tickler unit may be mounted on a panel in the usual manner.

Next come the primary and secondary coils. These are both wound on 8 1/2 or 2 1/2 in. spider-web forms. The primary coil consists of 12 turns of No. 18 s.c.e. wire and the secondary, of 50 turns of No. 26 enameled wire.

The mounting for these two colls is in the form of a bracket made as shown from a strip of brass. A machine screw passes through them, with a nut between to separate them about 1/2 in.

The bracket should be fastened to the sub-hate at a point that allows the tickler coil, at its full extension, to come as close as possible to the secondary coll without actually touching. The secondary coil faces toward the condenser, and the primary toward the rear of the base.

In operation this arrangement is simplicity itself. The primary is aperiodic and responds equally well over the ordinary band of broadcast wave lengths. The secondary is tuned entirely by the variable condenser. When the tuning has been accomplished, the proper amount of regeneration may be obtained by moving the tickler coil in and out. Finally, a sught readjustment is made of the secondary condenser and the tickler

The unit may be connected with any vacuum-tube detector and audio-frequency amplifier

How to Construct a Press for Your Tennis Racquet

XXINTER evenings provide an opportunity for making and repairing sporting equipment and doing the odd jobs the outdoor man or boy is not so apt to undertake at other times of the year. One useful piece of equipment that may be made is a tennis press.

The type illustrated is a modification of the usual square press. Three of the sides are 11 in. long; the other is 515 in Any light-weight wood 11/2 in, wide by 54 in, thick will do. The one shown was made from the towel-ruck of an old ash

washstand. As the press is composed of two The racquet in the press

frames, one for each side of the racquet, cut six places 11 1/4 in, long and two 5 1/4 in. long. Next, construct a small miter-box of three pieces of wond; make one angle sawcut of 38 and another of 58 degrees, using a protractor for the purpose.

The 38-degree joints are at the lower ends in the illustration and the 55-degree joints at the top. Assemble the frames on the beach, and, with the aid of a vise,

make a sawcut in the edge of the wood at each corner so that the shit shows 1 1/4 in. long. Keys of veneer or pieces cut from wood from fruit baskets are inserted in the shits. See that they fit snugly.

Method of using corner frame litys

Spread glue evenly at the joints, and insert the bits of thin wood into the naw cuts. Work quickly if

you are using hot glue.

Aslow several hours for the glue to set. Trim off surplus wood, and round corners neatly. Plane lightly if there are any inequalities in the fit of the joints. Finish with sandpaper

Bore holes in each corner to accommodate 8-in, bolts of 3,-in, diameter. Use bolts with round heads and wingnuts that screw down on washers to save the wood. -Austin G. Tribute, Toronto, Can.

Merry-Go-Round Furnishes Fun

(Continued from page 96)

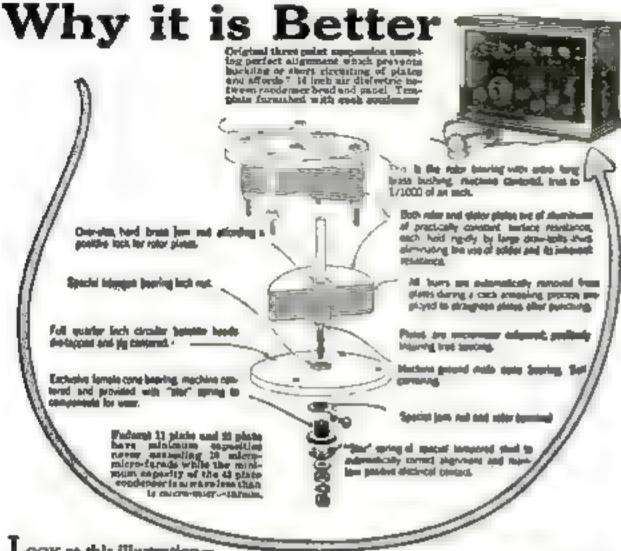
screw. The pole should be left overnight so that it will be frozen in soudly."

Mount a 12-it.-long plank on cop of the wheel and fasten a rope at each end to hold the seats. These are built of 2 by 4 in, by 12 ft. pieces held about 1 ft. apart by four short pieces arranged as shown. Run the ends of the ropes through holes bored near the ends of each seat and knot on the under side.

A little axle grease for the wheel bearing will help, and the friction can be reduced further by the use of a large from washer between wheel hub and post top.

While the device is intended for turning, it can be made to oscillate if the center cleats are omitted and the seat stringers set 2 or 3 ft. spart.





LOOK at this illustration. see for yourself the eleven distinctive features in the construction of the Federal Condenser. Every fearure is a distinct point of superiority—sesential to clear, shorp tuning and clear reception.

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UCILAGE and pasts are so constantly used that one guite often finds the supply has run out just when it is most needed. It is a simple matter, however, to make up a far of adhesive from materials that are or should be in the chemical cabinet of every reader of this column.

Gum tragacanth is excellent for making mucilage, as it has great adhesive properties and also is cheap. One ounce of this gum is sufficient to make a quart or more, depending upon the consistency of the paste desired.

Place a teaspoon of powdered gum in a large bottle. Add 14 cup denatured alcohol and mix thoroughly. Care should be taken to break up all lumps. The entire

gum should be in a very hne powder Then add 16 cup water and stir. A thick haste results. If too thick, thin with cold water.





for markeda directly. but les grans-WARRY OF BUILDING down con be made frite physing, plenhol horan and a dye

Another mucilage can be made by dissolving 1 teaspoon of gum arable in 1/2 cup of water, adding 5 or 6 drops of glycerins.

If desired, these gums may be mixed, but there is very little advantage over the guma used individually and it is not recommended.

The above pastes are acid free and therefore are adapted for mounting photographic prints, for which a glue free from chemicals must be employed. This does not mean that this paste is restricted for this purpose; it can be used wherever paste of any character is to be employed.

At times it becomes necessary to write on glass, especially on bottles kept in the home workshop. This is accomplished most conveniently with a specially prepared ink. Dissolve a rounded teaspoonful of shellas in 7 teaspoons of alcohol. Then dissolve in another glass 1 teaspoon borax in 8 teaspoons of water, When both have dissolved, pour the borax solution carefully into the alcoholic shellac, stirring continually. This darkens the shellar solution.

Now add any dye to color the liquid, (Continued on page 133)

Home Workshop Chemistry

(Continued from page 132)

but first try a small quantity, about a tesspoonful, to see if the resulting color will be dark enough. Such dye as rubber-stamp ink can be used, and if this is not available, it is possible to use the lead of an indebble pencil. This lead will dissolve in the liquid and dye it sufficiently for use,

Apply the ink with either pen or brush. The result will be a ground-glass effect in the color of the dye employed.

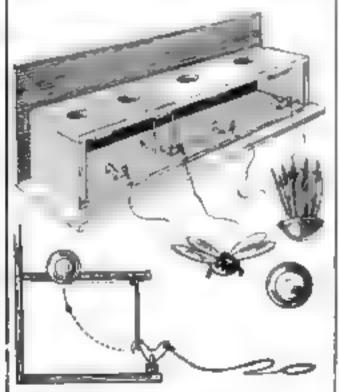
To remove a rusted machine screw from metal parts, put a little oil on the screw. Heat a long from wire over an alcohol burner or other heater to red heat and hold the wire on the screw head for a minute or two. Let the screw cool, adding more oil if all has evaporated. When cold, the screw usually can be removed with case. If it still refuses to loosen, heat again and apply more oil. Thus is one of the best and quickest methods of removing rusted machine screws.

"Catch 'Em Alive" Game

(Continued from page Pd)

like stage scenery. This is to prevent the catchers from seeing the flying objects until they are well in the air

The objects may be light celluloid balls, shuttlecocks or light birds or flies made of wood and wire. Their varying weights will give different rates and directions of flight, thus adding to the excitement. Each butterfly net is a ring of wire about

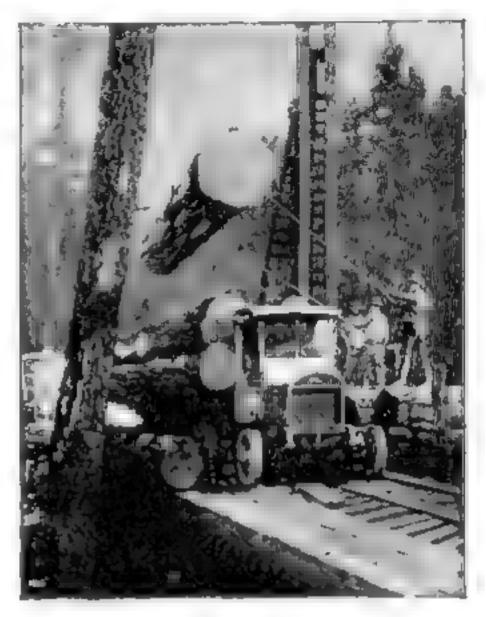


Plat shouse-traps or springs taken from them are need to shoot the objects into the six

6 in. in diameter, which is fastened to a light handle and covered with a small net.

To play the game, one person pulls the mouse-trap springs down until the catches engage them, places the objects in the holes, and springs the traps, one at a time, by pulling the strings. The strings should be bunched together so that the players will not know which trap is to be sprung.

ANOTHER ingenious and amusing game—one of quick wit rather than dexterity—has been designed by Captain McCann. How to make it will be told in the January james of POPULAR SCIENCE MONTHLY.



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Setting Up Your Christmas Tree

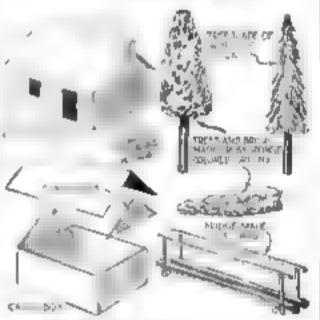
(Continued from page 91)

the paper is wet, but will be almost indistinguishable beneath the coating of plaster after it has hardened. Indeed, there will be just enough printing visible to give the grayish tone of weather-worn rocks. The more time you spend in shaping crags, peaks and other mountain formations, the more realistic the mountain will be. The effect will be enhanced by lighting the model so the rocks will project strong shadows.

Care should be taken to conceal with rocks and boulders the edges of the pancontaining the water pool. Small stones may be scattered in the foreground and used for ballast for the railroad track.

Trees may be made in several ways. Pieces of sponge dipped in green paint thinned with turpentine to the consistency of stain, make excellent trees and brush. Sticks may be fastened to sponges for tree-trunks.

Another form of a toy tree is made by whittling shavings on all sides of a stick, from one end to within an inch or two of the other, leaving all intact except those at the end, which should be cut off



Senta Claus a log cabin, a bridge, and two types of simply made minimize trees

to make a pointed tip. Whittle the other end of the stick round for the tree trunk. The homemade trees and brush are illustrated in the accompanying diagram.

The mountain model would be incomplete without Santa Claus's cabin. Use a candy box for this. Fasten two pieces of cardboard to lts top to form a gable roof, and fill in the gable ends with triangular pieces of cardboard. Use pieces of grapevane, muraing-glory vine, or any small twigs for the wall logs and stick chimney. Coat the cardboard walls with glue, except at the doors and windows, and lay up the twigs in log-cabin fashion. Details of the cahin also are shown

Throw a pioneer bridge across a chasm for a foot trail crossing, as suggested in the upper photograph on page 91. Make this of tree branches with smaller pieces for handrails and supports (see the diagram above). And do not forget to put up a telephone wire on poles, and to rig up a radio aerial, that Santa Claus may have communication with the world.

A few small animals such as can be purchased in novelty stores may be

(Continued on page 135)

Improving Hot-Air Furnace Pipes that Do Not Draw

MOST hot-air heating systems have at least one pipe that does not seem to draw heat to the same extent as the other pipes. Such a pipe may be improved by extending it into the hot-air bonnet so that it reaches over the center of the furnace radiator and gets a greater proportion of heat than the other pipes.

To provide such an extension, remove the pipe at the casing and form what I call

SHEET METAL ROLL OVER HOT A R PIPE

PIPE EXTENSION OVER HEAT CENTER



Two hot-sir pipe extensions, one for a pipeless and the other for a pipe formers

a "thief" from a piece of tin 20 by 28 in. It should be small enough in diameter to slip through the pipe collar. Cut off the bottom of it at an angle, as shown, and fastan it with wire, to hold it in shape. Then insert it in the collar with the open side over the furnace casting. Replace the main pipe, fastening the joint solidly and covering it with asbestos paper

The circulation of air from a so-called pipoless furnace can be improved in the morning, when the house is cold, by placing a rolled-up tube of metal about 18 in, high over the warm air or central portion of the floor register. This carries the bot air higher in the room and creates more rapid eleculation - (W. HUBERTZ.

Sandpaper Roll for Lathe

VERY one who works with a wood-L turning lathe knows the time and trouble that can be saved by putting sandpaper on a round piece of wood and let-



The sandpaper is held by a wedge

ting the lathe do the work. problem of how to attack the sheet of eandpaper to the wood has been solved in my own case by the method

illustrated. All that is necessary is to turn the wood, saw out a wedge, and bore and countersink three acrew holes. the sandpaper around the block, putting the ends in the groove; then screw the wedge in place.—E. J. Q.

Setting Up Your Christmas Tree

(Continued from page 134)

stood here and there among the rocks, and Santa Claus himself may be on the trail to bin cabin. Goldfish in the pool will keep its surface in ripples.

While it is well to lay the railroad tracks in the early stage of construction, to make certain that the tunnel openings are correctly placed, the electrical connections should be left until the last. The transformer or batteries may be concealed within the mountain, but it will be better to have them, as well as the starting switch, exposed at the back of the model



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Repairing Flush Tanks Fanquerry leaks in touct tanks are never noticed. Only when a water-bill of

\$25 or more arrives, is there a hurry-up call for the plumber

Much expense, both for water and for plumbers, can be avoided if the homeowner will learn how the "Innards" of a toilet tank operate and go to the trouble of making the repairs himself. Most plumbers are glad enough to have you do such jobe yourself, as in these days of intensive building, they do not find these minor repair jobs especially profitable.

The one way to make sure that the toilets in your home are not leaking in to give them a thorough examination. Put your ear down near the tank of each one

and listen. If you bear a murmur, it means there is a leak.

The rod with the round copper float on its end, which you see extending across the tank when you lift off the cover, cometimes gets out of adjustment so that it fails to shut off the inflow valve before the water in the tank reaches the top of the overflow tube. As a result, there is a slow, constant drainage of

To remedy thus, bend down just a little the rod to

which the copper float is attached. This should be done carefully by bending the rod in the middle when holding it in both hands. Do not attempt to bend the rod by grasping the copper float, as you simply will twist it loose. If necessary, you can unscrew the float first. Next, unscrew the rod itself, then lay the rod on the floor and hold half of it with your foot while you hend it up.

The effect you week is, of course, to make the float rest a little lower down in the tank so that it will shut down on the incoming water a little sooner. There should be 14 or 1 in, between the surface of the water when the tank is full and the top of the overflow pape.

It is not necessary to shut off the water before making this adjustment.

Undoubtedly the greatest single source of trouble in toilet tanks is the rubber ball that is supposed to close the outlet of the tank. It often swells or gets hard, which prevents its making a tight seat with the rim of the flush valve.

You can find out whether the ball is

defective by feeling it. Also look into the bowl of the closet and see if there is a dribbling of water. If so, you have learned why your water-bills are unreasonably high.

If the bell seems defective or is old and worn-looking, the cheap and effective remedy is a new one, which can be purchased from any plumber for less than a dollar. There also is on the market at \$1.25 a pure gum tank-ball of different design from the ordinary variety. This patented mushroom ball is of heavy, pure rubber, and is guaranteed for three years.

The tank-ball should be unacrewed from the rod or "stem" to which it is attached. You may find the thread so corroded that it breaks when you start to unacrew the ball. If so, get a new rod

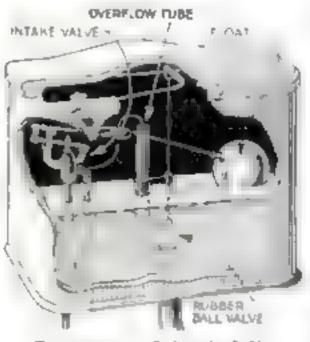
along with a new ball. It will east only a few cents. A phosphor bronze tank-ball atem, which will not correde as soon as the commoner kind, is worth getting.

A third frequent cause of leaks is that when the toilet in flushed, the rubher ball does not drop back into correct position, but rests a little off center and does not completely close the This freoutlet. quently is due to the guide-arm's being slightly out of alinement with the

center of the flush valve. The remedy is to loosen with a knife-bade or other thin strip of steel (there is no room to operate a screwdriver) the screw that holds the guide-arm on the overflow tube. After loosening this screw, rotate the guidearm until the stem and ball are exactly over the center of the flush valve.

A fourth danger spot to examine for leaks in the foot of the 1-m. brass over-flow tube previously mentioned. This tube has a fine thread on its lower and, where it is acrowed into an outlet leading into the flush pipe. Corrosion often starts a leak in the thin metal where this thread is exposed to the water.

Test the condition of the overflow tube by seeing if it is firm. Sometimes a slight twist will cause it to break off at the bottom because the threaded part is eaten half away. In case it is defective, a new tube is to be obtained at your plumber's for about 60 cents. The usual size is 1 by 11 in., but it is safer to measure the old pipe or take it to the plumber to be matched. There is now on



Few repeirs to a flush tank of this type require a plumber's services

Continued on page 137)

137

The Shipshape Home

(Continued from page I in

the market an overflow tube made of hard rubber, which will not corrode

If the tube breaks at the bottom, the remaining fragment of threaded pape a be got out of the socket into which it is screwed. This is not hard to do, as the corroded metal is soft and pluble. Care must be taken, of course, not to damage the thread into which you want to the new tube. The guide-arm attains to the overflow tube must be removed before you can make this replacement.

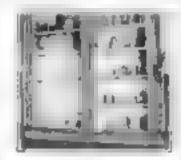
If any least you discover are not larged to one of the piaces mentioned, by all means call a physical rather than leave them a attanger is in I

Shadow Cupbourds

press or cupt and made by leaving space between the

studing when the room was lathed and plastered. It measures 4 by 4 ft. and is the depth of the 2 by 4 in, studding There are five shelves each side of the

center studding and the outside is ir moved with casing just as are the doors and windows. The back and shelves are covered with obeloth. We to curtains make It.

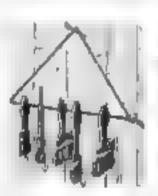


look dainty -- MRS. JOHN CLARKSON

Paint-Brush Holder

A manufacturing for the adapthage of a a part break before All that is

needed is a length of stout wire; this will have to be about 26 in, long to hold 19 or 12 brushes. One end is turned up for about 1 in to make a book. Eight inches



from the point the war a hant at an angle of about 60 tegroes, and 8 in farther a summar bend is made. The end of the wire is then heat a trifle to hold in the book at the other end

A hole slightly larger than the wire

is druled in each brish about 16 in from the end of the handle, so that the brushes can be run on the wire and hung up

Disconnecting a Sill Cock

When no method has been provided for abutting off the garden-hosesall-coef-

to prevent its freezing in cold weather is well to turn off the water temperar:

disconnect the pipe that lends through the foundation, and plug it. If the water has in the usual mass to-in, pipe, an old a nutomobile spark



plug may be used as a plug. In the spring the sill-rock and connecting pipe can be replaced readily —O. M. A.



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The Shipshape Home

(Cantanued from page 137)

Applying Weather-Strip

Very few bomeowners would tolerate a broken window or a glass panel

removed from an outside door, yet many homes have unprotected windows and doors with many cravices. The openings may be inconspictious, but they add to the fuel bill and detract from the family's comfort. Only plumbers can tell how many pipes burst every winter because of cold drafts of air from ill-fitting windows and doors.

The work of weather-stripping a house is far from difficult unless some of the

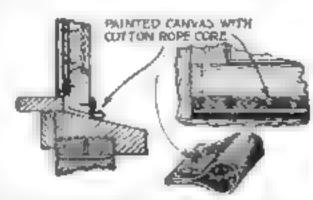


Fig. 1. Homewade weather-strip made of canyne and out cotton rope, featured with brees tacks

special patent motal weather-strips are used, when a skilled worker and special tools are needed. Luckily the home worker can obtain good results with the simpler types of weather-strips.

Combined wood-and-felt and wood-andrubber strips, metal-and-rubber strips, and flexible rubber and felt strips are common varieties that can be purchased at hardware stores. Preference and price govern the type selected, but all are good if properly applied. Indeed, the ingenious home-owner can make up weatherstripping in an emergency from other material, if be wishes.

One of the best improvised weatherstrips that the writer has seen was an ap-

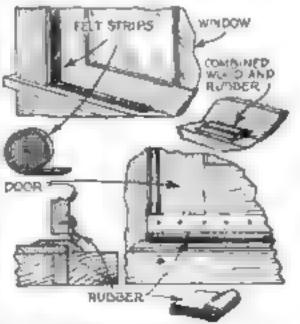
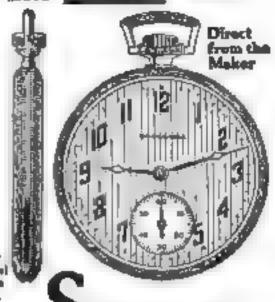


Fig. 2. Method of applying felt, rubber and combined wood-and-rubber or wood-and-felt strips

plication of cunvas and cotton rope, illustrated in Fig. 1. Strips of canvas 214 in wide were folded over a rope core made of soft cotton string. These were fastened with brain tacks spaced 2 in, apart. The strips then were painted with linseed oil (Continued on page 139)

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The Shipshape Home

(Continued from page 138)

and lead. This made durable, nest, and extremely serviceable insulation.

In another instance a home-owner who had difficulty in obtaining weather-strips that would be effective at the lower edges of the doors, cut some strips of rubber from old automobile inner tubes. These were folded and tacked on, the rubber forming a cushion-like inclosure. This proved so satisfactory that the owner substituted the homemade weather-stripping throughout the house.

There are a few points to remember in applying the simpler types of weatherstripping mentioned above. At the bottom of doors it is preferable to place the strip on the outside edge of the door, if possible, but if the door swings in the strip often has to be placed on the inside so as not to interfere with closing the door. The side stripe for the door are

placed on the door-stops. If the inside stope of a common doublehung window-such are fitted tightly enough against the lower sash-and they can be removed easily and made tightit usually is not necessary to put weatherstripping around the lower sash. However, a strip on the outside of the bottom rail of the lower such is sometimes desirable and is especially so with the

casement type of window. At the junction of the upper and lower mash, there is usually no need for weatherstrip, if the catch is adjusted to pull the sashes close together. If necessary, a single thickness of felt or rubber may be placed on the beveled inside face of the

meeting rall of the upper sash.

Where wenther-strip is mainly necessary on windows is around the sides and top of the upper such on the outside. Weather-strip made with feit should not be natical so as to press too snugly against the window, as it may swell.

The careful worker will find it advisable to tack on weather-strips at first in a few pinces and then move the windows up and down before nailing the strips solidly.

The value of weather-stripping depends upon the care taken in fitting it, and even the cheapest grades of commercial strips or improvised strips can be made to exclude the cold.—G. A. LUERS.

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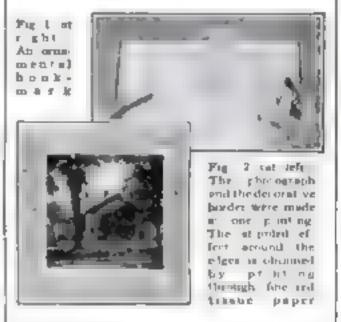
Oopt. 1750 Daylon, Ohio

Artistic Gifts Made from Photo Printing Paper

By Kenneth B. Murray

ARTISTIC gifts made in the home workshop may be enhanced in many cases with the aid of photographic printing paper so treated that it has the appearance of shiny, fine grained marble.

The paper is made by printing in the ordinary way, using as a negative a piece



of thin red tissue paper. An exposure of five or 10 seconds is sufficient. The red timus has tiny holes in it, invisible to the naked eye. The light passes through these holes and gives the marble effect to the printing paper. Development is made in the usual manner.

Figure 1 Illustrates a bookmark of double-weight paper prepared in this way. in Fig. 2 is shown how the ornamental

paper obtained by this method may be used to forza a border for a photograph. In this case the red tissue has a hole the mixe of the pegativa,





Fig. 1 (above) Silhouette applied to Christmes package

Fig (at luft): An enelly and chraply mede desk clock decorated with photograph

the negative itself takes the place of the tissue cut Rath border and parture are printed at the SHAME SAME.

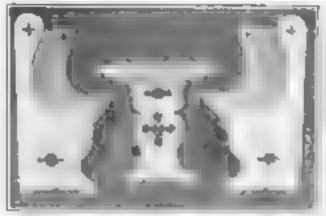
A novelty in the way of a silhouette cut from the

paper and pasted on a Christmas package m shown in Fig. 3.

By using double-weight paper and reinforcing it with cardboard, a pretty desk clock can be made, as in Fig. 4. A picture of the donor is printed on the paper at the same time the marble-like effect is pro-(Continued on page 141)



Pullman Dining Alcove Built from Home Workshop Blueprint



Dining alcove made by 16-year-old John Matchell from Home Workshop Blueprint No. 33

I JSING POPULAR SCIENCE MONTHLY'S Blueprint No. 33 as a guide, John Mitchell, of Point Pleasant, N. J., who is only 16 years old, built the Pullman dining alcove illustrated above. He writes:

Inclosed you will find a photo of a duing-above ect made with the aid of your hipepent was all tound very clear to understant. It is given a sequenced by all who seem, they think a great deal of the back and have made many media in page women the house from the fluring my vacation from actival. Ifum 16 years of age and attend high school.

Those who read L. Porter Muore's article last month on built-in features and wish to construct a modern breakfast corner will save time and money by obtaining this blueprint ...

This month's new blueprint is the simplified bookcase illustrated on page 92.

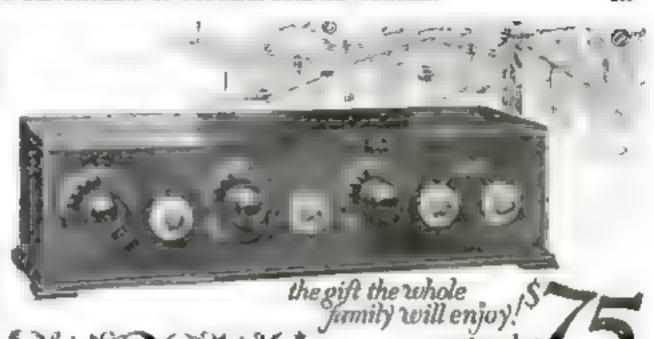
Complete List of Blueprints

ANY one of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 26 cents. The Editor will be glad to provide, upon request, information relative to tools, material, or equipment. Blueprint Service Dept.

Popular Science Monthly 250 Fourth Avenue, New York

City and State

Send me the blueprint, or blueprints, have underlined below, for which I inclose.......eenta:



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W. J. Morey man, New Lastinia 1800.

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mented up my Manie and erect of the age more many actives board and for Fagure and and record for journal bag je haphim A M Ursan-der, Winsted Com.

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Treatment its tested and approved basses) it dry cells.

OtherMunacoLong Distance Sets *]



This wooderful new M turn Motel This wenderful new M here Month in the Bree tune tone dis an elegal speaker are than her reacted only a sequence of the sequence of the control of the contr

test franciscopy of the started of t an appear must see feater of \$50.00.

> The Improved Margon 19 5 Model MW with filamore was in telesce at the pa-mount of out has never in the life of the light peers to receive which is not to per frames girl oil distances even our per frames grad oil distances even to the person of the light and to the light of the ligh dove the

Maraco Model & to called by Maraco Model II to called by salem Radius a filteral rate practical quality from Mr. Of the cate acts are a turned radius i repleases amplifier and detector combined A great distance peter. Rany in Operace and Jun. Covern all waves lengths 150 on 625 meters, Like all Maraco area, it was all maracological balance as a filt with all Maracological part its relia. Never and hange before at

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USY in more in you can show me that you are the right kind of a manthat you have ambition, and spunk and are determined to better your position and condition in life—just they have one I that I can show you a plan whereby you can make a success in this new field and reach your goal.

Radio has grown from nothing within these years to be one of the greatest industries in this country. I am satisfied I can show you a plan whereby you ren make bug money in territory not already covered, the same as I have

The Caurks Pian a the first and only one of its kind which enables the Everage mats to start a manufacturing business of his even and pay no one any unnecessary peofit. It will give the right it not of a man an opportunity to get on his feet even in his operations and retablish himself in a permanent and profit able business of his own

The man I am soulting for is having a hard time making ends most. He is willing to starn willing to try and try hard if he can only be shown and given a helping hand to get started.

The man I am Locking for is not a "floater" He has a good position and he has held that position for some time. He is well and feverably known to his community he is honest hard working and industrious. He may not have much money—he is not completely broke and looking for a job. Clearstally he has a family and wants to do the heat he can possibly do for that family

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net "out of the rut"—how in pall themselves up and get on their feet. I am satisfied I can do this fee you or any other man of you are wifing to do your part. The public is buying ratio instruments more and more every day and yet in this wonderful huntrees there is a field wide open for you.

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is free for the salting and for any man who is de-termined to improve his condition it will no doubt be just what he is looking for ... It has been the turning point in the lives of a great many men it will mean the same to you. At any rate, you will enjoy reading it, because it is a story of men.
 a story of their successes and failures. It proves why some men fall white others succeed. It shows clearly why a few men in this country are the emplayers of mobe of men who are toding dody to make millionares out of a few

Thousands of mun have written me and stated that this book is the most wonderful story they have ever read. After all, it is the story of myself

and the Courks organization, who have started from absolutely nothing in this world and pounded our way to exceen without even the advantage of what is now known as on education

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tril me what you are now dring end sak for Book No. 100 In doing to however don't DOUNTY

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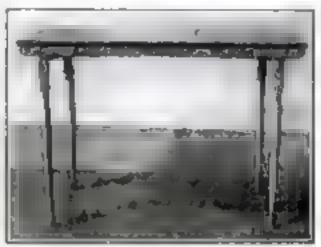




Light Folding Table Built to Give Long Service

THIS folding table for eard-playing or occasional use, may be built of clear pine, basswood or one of the more expensive cabinet woods.

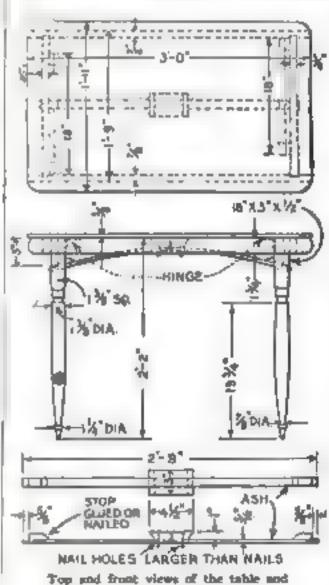
The top is 👫 by 28 in. by 3 ft, with rounded corners. On the under side a frame is fastened by means of flat-head wood screws. The frame requires two strips, 1/4 by 15/4 in. by 3 ft., which are



This metal titue tobic may be stored to a small epace, so the legs fold inward

connected 1 in, from each end by two grow members, 36 by 136 by 20 in.

The four legs are turned to the dimensions shown from 134-in. square stock. Each pair is connected by a strip 14 by 8 by 18 in. They are fastened to the top by mount of table hinges or other extra



wide and beavy hinges, although ordinary butt hinges will serve.

details of the wooden spring ratch

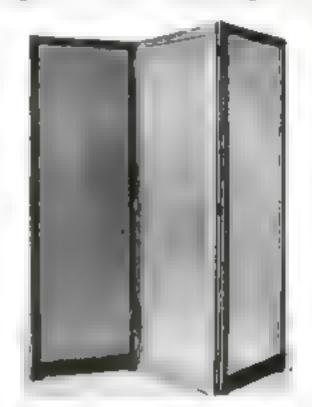
Located centrally on the under side of the top is a block to which a strip of ash, 5/16 by 1 by 32 in., is fastened. This strip serves as a spring to prevent the legs from collapsing when extended.

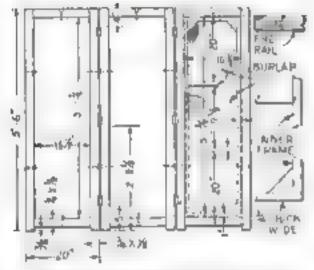
How to Make an Attractive Burlap-Covered Screen

ALTHOUGH the screen illustrated be-low is simple in construction, it may be placed alongside the best commercial furniture. Mahogany, walnut or cherry may be used, as the builder desires.

The stock should be finished 1/4 in. thick. First, make the six side members, each having a length of 5 ft. 5 in. and a width of 1 1/2 in. The six end rails are each 1714 in. long and 1% in. wide. That allows a tenon 1/4 in. long on each and of the rails.

Each frame is assembled with a good grade of liquid glue. They are hinged together with six double-acting screen





The finished screen and details of the construction of the outer and inner frames

hinges, which are to be obtained at any well-stocked hardware store. The frames are finished in shellac and wax, or varnished, as preferred

The burlap covering is tacked to frames of spruce or similar wood, which are made to fit inside the outer frames. Details in the accompanying illustration show how the corners and cross members are juined. The outside dimensions should be slightly less than the inside dimensions of the outer frames. They are fastened together only with glue and nails, so the covering material gives additional strength.

These inner frames are covered on both sides with burlap or other material, fastened with small carpet tacks, and then are held in place by means of flat head brass wood screws, which pass through the rails of the outer frames.- W. J. E.



Money and a Barrel of Fun!

First-Class Saxophonists make big money, and the work is easy and pleasant. You might easily become a wizard like Tom Brown, of the famous Six Brown Brothers or Ross Gorman, Saxophonist with Paul Whiteman. Or you might be a great record-maker like Clyde Doerr or Bennie Krueger or Joseph C. Smith. \$100 to \$500 weekly is not unusual for musicians of such ability to earn.

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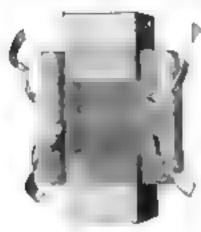
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The Therdarion-made layer-tenand Rell Alle and the mught around the square core, the cap's turn put these chruits que by layers slipping. No air spaces between rail and cute radiation Thordarion beattrest no lost energy on host volume (squarisity on low nouse no leaks trum pri-mary to enque havis in act, (Thordarions are quest, some on-the third stages) over-size core (An order service the private thin-patient core losses, prevents over-saturaling. Except ribbon leads locked in the cold give short, firset and made of layers of the forest and passes durable countryfriend and passes durable connections to the passes of limits before the passes of limits between the property of the Thirthetens training connect connect completely projected, which got and tighty classes he are the training of the project of the passes formers for more makers of que ity

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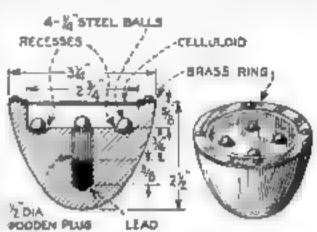
HFRE'S an all-round woodworker for the small shop. Sturdy, fast and true. The biggest little woodworker ever built. Saw table has 8-in. rip and cross-cut saw, and 4-in, jointer and horer, You can choose from these extra attach-menter band saw; shaper; sander; lathe; and motor, Send for Bulletin C.S and complete Parks catalog.

The Parks Ball Bouring Markins Company 1547 Knowlton St., Cincinnati, D. Counties Factory: 300 Holes Come East, Manifest, Con.



Spinning the Container Solves Novel Four-Ball Puzzle

TO PLACE the four balls of this puzzle in the four very shallow holes is an in the four very shallow holes is an amusing problem. The natural way is to Incline the cone, so that the balls can be placed one at a time. You will soon find, however, that you cannot succeed along those bass, for placing the second



The puzzle and cross section through it. Note load weight that aids in spinning it

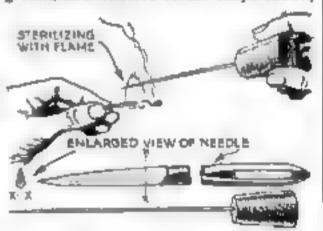
ball causes the first to roll out of its recess. The trick is to spin the cone like a top

The cone is turned from dry wood and a receas in cut in the top for a calluloid disk. The best way of holding the latter is to cut a ring from thin brass and fasten it with six small wood screws.

A lead filling must be provided to make the cone spin well. A hole 14 in. in diameter and 1 by in, deep is drilled in the center, and melted lead is poured in to a depth of about 1/4 in. The hole is then closed with a wooden plug. The balls are from an old ball bearing.-C. A. O.

Small First Aid Lancet Made from Darning Needle

GOOD surgical needle of the innest A type for home use can be made from a large darning needle. The point is ground and whetted to the chaps shown,



How the point of the darning needle is sharpmed and sterilled with fire before use

which gives a keen penetrating and cutting edge. A cork pushed on the eye end serves as a bandle.

Before using such a needle, steriluse the point by holding it in the fiame of a gas jet or match.-J. R.

For mending small cracks in steam botlers of house-heating plants, a good cement can be made from two parts finery powdered lithurge, one part very fine aand, and one part of quicklime that has become slaked through exposure to the air Just before being used, this mixture is moistened with boiled linseed où to a paste-like consistency

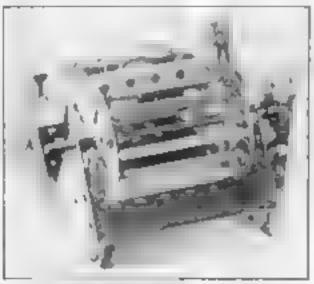
NEWEST STYL

dentili pere ar betagen af tama care. Holde one parkage. Begrup sp. marana Maranca.

Constructing a Toy Motor from Junk-Box Parts

WO electric magnets, obtained from an old door-hell, and a battery furnish the power that turns the armature of this simple toy electric motor of unique design. When the circuit is closed, the magnets attract soft from bars or rods, which are firmly fastened to two wheels taken from a toy construction set. The circuit is broken or interrupted as the bar , approaches the magnet in such a way that bare are attracted in succession, thus causing the rotation of the shaft.

The shaft carries eight of these from bars, and also eight contact points, which are nothing more than short bolts. The current leading into the magnets is con-



Old bell magnets and discarded toy parts were used in making this electric motor

nected with one pole of the battery. The other pole of the magnets is brought to the metal upright that carries the shaft.

Insulated by a piece of wood, a metal arm rises above the shaft. To this arm is fastened a wire so that it makes and breaks contact with the bolts as they pase by. The remaining pole of the battery is connected with this arm.

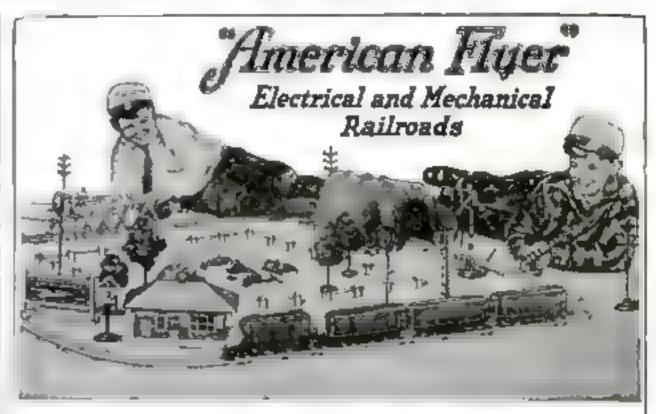
The current flows through the magnetawhen the Iron bar is just above them; but when the bar is in line with the magnets. the current is broken. Momentum turns the shaft past the dead point and contact is again made between the wire and the next bolt-head. This allows the current to flow through the magnets and they nttract the next bar. The current flows only for an instant or so, just long enough to attract the nearest fron bar, whereupon it breaks until the next bar is attracted. Any battery or door-bell or toy transformer giving six volts will tun this little motor.-E B

Cork Tips Prevent Chair Legs from Scratching Floor

ORK tips on chair legs will Contract varnished or wated floors from unsightly scratches. At the same time the corks make the chair relatively noiseless.

To attach the corks, bore a hale 14 in, deep in the bottom of each chair leg. Fit into the hole either an ordinary bottle cork or

a rubber stopper, allowing it to project 12 in, or more. One set of corks will last many months and when they are worn down, it is a simple matter to replace them.—K. B. M.



TRAIN ILLUSTRATED ABOVE

Ha. 1307 — Twentieth Contury Limited: exact capp N. Y. C. Electric Lecounting with headinght and automatic expense, must care 1 Pullmans all electric lighted:—20 pieces of track. Longth of track 48 inches—track 168 inches. Price, delivered. \$28.00

The World's Fastest Train!

THERE it goes! WOW-What a pick-up!!
"Hey slow it down Bill-there's a curve shead!" shouts Pinkey the new American Flyer fireman. Bill doesn't move -the American Figer roars on-hits the curve gaining speed all the time - its again on the straightaway speeding and roaring towards the first stop.

"Stop it Bill! We pick up the mail here," cries Pinkey as he looked anxiously shead.

"All tight Pink."

Bill the Engineer figures just where he wants to stop in order to pick up the mail - he shate off the power - the American Flyer slows down and comes to a dead stop without the alightest sign of a jar or shake.



No. 1221: Electric Engine, with heedilght, I looken 3 double-truck care, 6); locken, 14 places of track, semaphore, station, tounel; theosist and track connection. Length of train 31 larkes. Price, delivered, \$12.00



American Fiver Transformer Prior, delivered



No. 2-Mechanical Engine, with brake and piston rods this inches, tender 4 lockes, cars 5th sches, buttage our has sliding doors. M pleces of srack, 163 mekes, length of train, 21th mekes. Print, delivered, \$2.55 Price, delivered, 32.65



No. 13 Mechanical Engine, with brake and pinton rads 7 inches, tender 6 inches, cars \$\frac{1}{2}\$ loches, budgage car has sociated doors; 12 pieces of track, 2 awarches, length of track 160 inches, length of track. 25 tuckes.

Price, delivered, \$4.25 Price, delivered, \$4.25

If your Toy Dealer ham't got the "American Flyer" train you want —we will send any of the above outher postpaid on receipt of price

Send ten cents and set will mail yet Horace Wade's famous story about "The Backyord Railroad" and the heantiful catalogue illustrated to color showing the full line of American Flyer Trains

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Put that 20% saving in dollars and cents. Figure it up on the amount you spent for coal last year. Add up how much a 20% coal saving means to you over a five or ten year period—and you'll decide that the inexpensive CROWN Fuel Saver is worth while investigating.

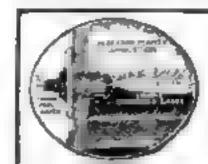
Money Refunded

The CROWN guarantee is absolute. Attach this amazing coal-saver and heat-producer to the feed door of your heating plant and you must make an actual saving in fuel of at least 20% or your money will be refunded without question, 20% in the minimum coalsaving possible with the CROWN; some users obtain yearly savings of 30%; others as much an 50%.

The CROWN burns "smoke". Greates Intense heat

The CROWN Fuel Saver may 🖿 easily bolted to the feed door of heating plant, It works automatically, providing by means of natural draft, an auxiliary supply of pre-heated air over the fuel bed. This pre-heated air agnites and turns into heat nearly all the gases

("smoke") that usually escape up the channey (See illustration.) The result is a slow fire, a tremendous increase in heat and a corresponding reduction in smoke.



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Mission-Style Rocker Is a Strong and Comfortable Chair

ONE piece of musion furniture that has maintained considerable popularity is the rocking-chair. It commends itself especially to the ameteur mechanic



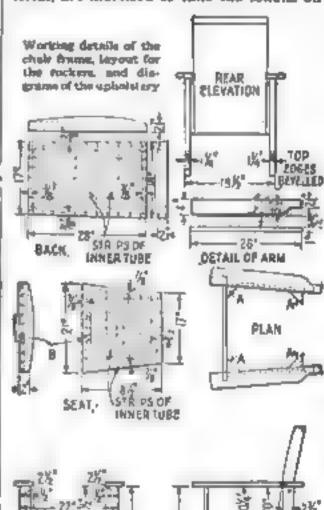
The completed rocker

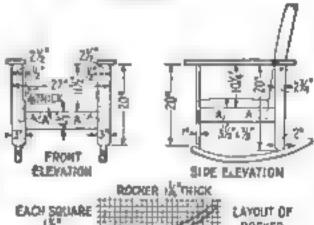
because of its ease of construction; and, besides, it is a most comfortable chair for the amokingroom, den, library, or living. room.

T h a rocker is built pre-

ferably of oak. The four logs are cut from 1-in, stock to the dimensions shown. They are mortised and tenoned to accommodate the arm rests, side rads and rockers.

The arm rests, also cut from 1-in. material, are mortised to take the tenons on





the legs. The upper edges of the arm rests are beveled.

ROCKER

The three rails that connect the legs are dressed to 1/4 in, and tenoned to suit the mortises in the legs. The rockers are cut from 1 14-in. etock.

When these parts have been prepared, they should be well sanded and assembled with a good grade of liquid glue. Set aside to harden thoroughly

(Continued on page 149)

AMERICAN BOY SCROLL SAW

N's Easy to Build Things When You Use This Saw You will the he starty.

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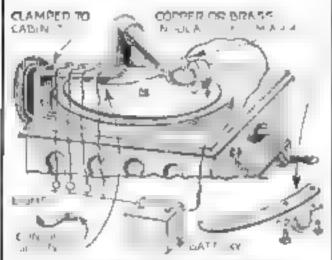
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Phonograph Turns on Lights to Music of Carols

By R. H. Kasper

AT CHRISTMAS any novelty appropriate to the season is enjoyed by the whole family, from the little children to the grown-ups. If one has a Christmas village, and a phonograph is available, a novel light effect can be produced with very little work.

The village is set up, the houses are equipped with low-voltage electric lights, and the phonograph is arranged as illustrated to switch on the lights suto-



How the restact pieces are attached to the phonograph, and diagram of the wiring

matically, one after another, to the accompaniment of a Christmas carol, such os "Slent Night! Holy Night!"

An arm made of copper is clamped to the awinging tone arm of the phonograph, but insulated from it. Directly opposite the copput arm, a piece of wood is clamped. to the cabinet so that there will be about 14 in, clearance between it and the copper etrip. This piece of wood carries a number of contact shoes, one for each light used. These are bolted to the wood and connected by wires with the lights

As the swinging arm of the phonograph passes acress the Christmas record, one contact after another is formed, flashing

on the corresponding lights.

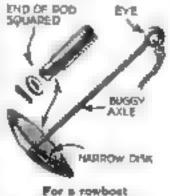
The contacts must be very light, so as not to hinder the movement of the reproducer across the record. The wiring is as shown; one side of the lights is connected with a common wire, which goes to the battery, and the other wire from the battery is connected with the contact on the tone arm of the phenograph.

Small Mushroom Anchor Made from Old Harrow Disk

A MUSHROOM anchor for a rewbest or rait may be made from an old harrow disk. A simple way to form the shank is to heat one end of an old buggy axle or similar steel or fron rod and

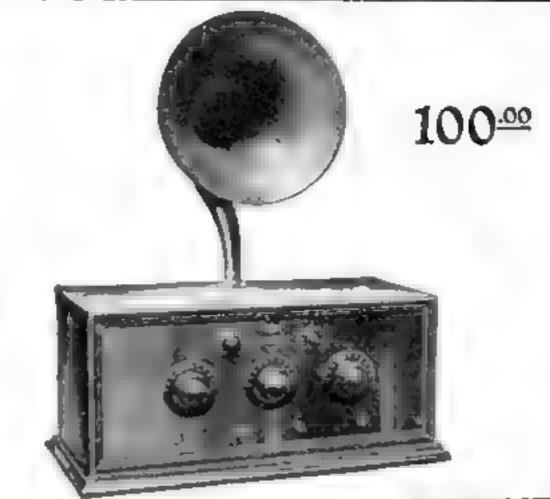
bend an eye for the anchor rope, squared The other end should be squared and fitted in the square hole in the dusk.

The disk bears against a shoulder on the end of the tod and a washer and large cotter hold it securely



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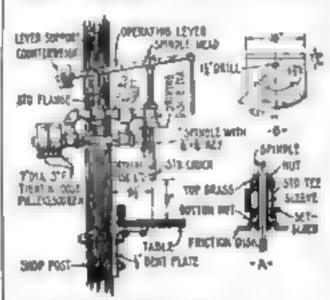
Post Boring Machine Built Largely of Pipe Fittings

By Frank N. Coakley

DERHAPS the easiest machine for the home workshop mechanic or the carpenter to make in the post borer illustrated. It is constructed from materials that are readily obtained. As the frame is made from 2 🕌 or 8-m. pipe and pipe fittings, the expense of constructing patterns is unnecessary.

The driving shaft is made from a short length of 1 1/2 in. cold-rolled steel. Keyways are cut at each end, one for the tight pulley and the other for the friction disk. The two tees that act as bearings are babbitted to the shaft size and a hole tapped in the side wall of each for a grease cup. Two collars are setscrewed securely to the shaft in the positions nhown.

To form a support for the bearings, a standard pipe flange is screwed to a short length of pipe, which is screwed into a toe between the two bearings. This tee is provided with a tapped hole for a 1-in, pipe, which is flattened to receive the lever



A side view of the boring machine and detask of fraction disk and table bracket

support. The lever support and operating lever are from 1 by 34 in. flat steel bars, rivated together. A pull rod is bung from the end

The spindle is a piece of 1-iz. coldrolled steel, keyed as shown.

The machine is provided with a friction drive. The driving disk is made from 2 round plates between which \$ fiber disks are clamped securely. These are trued up in a lathe. The driven or spindle disk is a piece of 14-in, plate, perfectly flat and smooth, fastened to a sleeve, as in the detail A. The bottom nut is provided with pinholes to allow for adjustments to keep the two disks tight together. The side of the tee at this point also is tapped for a greate cup. A 14-in, hole is drilled in the disk eleeve to allow grease to lubricate the spindle. It is a good plan to plug the pipe leading into this tee so us to keep the greass around the moving parts.

The table is so simple that it requires little explanation. The bent plate that acts as a bracket is provided with a circular slotted hole to allow the table to be tilted for angular drilling. This feature is shown at B. A wooden bench is fastened to this plate.

Care must be taken to make all the pipe connections perfectly tight.

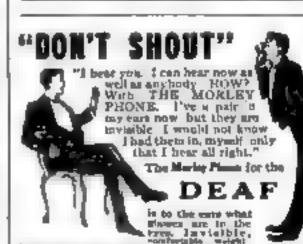


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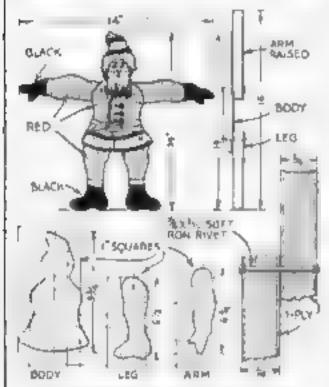
Making Durable Christmas Toys of Heavy Plywood

By Capt. Charles C. Hall

EACH of my four children has one of the Santa Claus dods illustrated and I have made others for nearly every kiddle in the neighborhood. Four years ago I made 14 of them and, except for some scratches, they are as good today as when made, and as well loved as any dolls.

The durability of these toys is due to the material of which they are constructed, which is 5-ply veneer 💥 in. thick, Five- or 8-ply veneer 14 in. thick ts more generally stocked by lumber dealers and it will do about as well. It is not advisable to use ordinary straightgrained wood, as it is upt to split.

A piece of veneer 12 in, square will be sufficient to cut out one dol). By dividing



The Senta Claus doll, detail of the joints and squared patterns of the parts

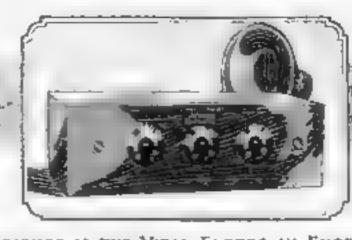
a sheet of cardboard into 1-in, squares and copying the patterns, it is a simple matter to make templets for marking the wood. Naturally, the arms and legs are rights and lefts, but this is taken care of simply by turning over the templets. I use a bandsaw in cutting out the wood, but a coping saw will do.

A 3/16-in, hole is drilled in the center of each arm and leg 16 in, from the end that fastens to the body. A corresponding hole is drilled in each shoulder and hip. If \$4-in, veneer is used, four \$/18 by 174 in, soft iron rivets will be needed. The rivets are driven through from the front and riveted in the back.

I have found that white, black, and red carriage paint gives the best results in finishing these toys, as it dries quickly and leaves a gless. The expression of the face is helped if a touch of blue is given to the eyes. The lips and end of the nose are red. The remainder of the coloring is indicated in the diagram

Waxing Woodwork Successfully

WHEN amateur woodworkers have trouble in obtaining a good wax polish, usually it is because they overlook the fact that a good waxed surface is insured only by the friction caused by bard and long continued rubbing



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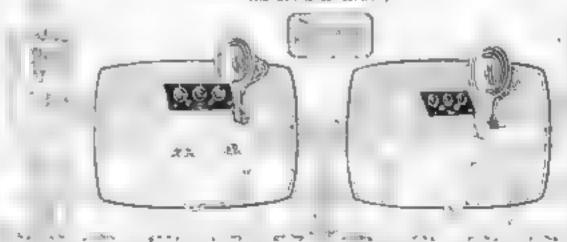
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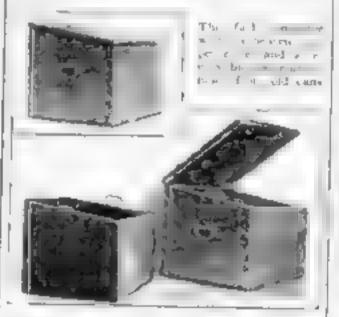


Building a Hammered Copper Wood Box for Your Fireplace By H. Caldwell

OVERED with bammered copper, this coal-and-wood box is at once a convenient and an attractive accessory for the fireplace. The richly colored metal catches the glow and light of the fire.

The box is very easy to make, as only simple butt joints are required. It may be of 35-in, pine, spruce or any wood at hand. The front is 11 by 18 in., the back, 14 by 18 in. The two sides are 18 in wide, 11 in, high at the front, and 14 in. at the rear. The bottom is 18 by 1614 in : the top 1514 by 19 in. This allows for the top to project 1/2 in. on the sides and I in in front.

The copper should be about 30 gage, cut large enough to turn I in inside the box and I in. on the bottom. The sides turn in, at the back, but are flush with the front at the front corners. These corners are bound with copper, for which two



strips 2 by 16 in, are required. They are bent at right angles after being scored alightly to insure a sharp bend.

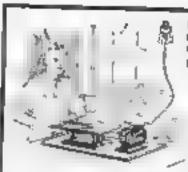
The hummering tool is made from a piece of bar iron % in. in dometer and 8 in, long. It is rounded off and polished at one end. The copper is placed on a piece of hard wood and the tool driven against it sharply with a hammer. Thus causes a dent, which may be made as light or beavy as fancy dictates. A conventional design may be traced and hammered if desired, otherwise the copper is covered irregularly with the inden-

When hammered and straightened, the copper is nailed on the box with copper nails. The top is put on with 1 by 6 in strap hinges and two handles are placed on the sides

The box next should be washed with a strong solution of hot water and sal soda Apply with a swab a solution of one tablespoon of liver of sulphur to a quart of water. This will darkon the copper al? over. Rub the box with a piece of hard felt dipped in wet powdered purice to brighten the high spots and leave the rest dark. Wipe off any excess powder and give the copper a coat of lacquer.

Put 4 furniture slides or, if preferred. copper feet on the bottom, and paint the innde and back with black paint.

A lining may be made if desired, from two 5-gal, shingle-stain cans, or other old cans, which also will provide the handles.



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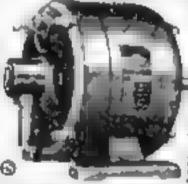
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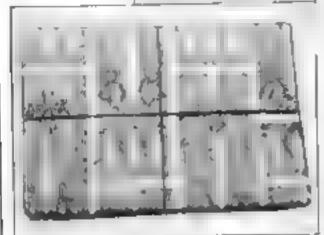
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Wrapping Presents in Wallpaper Is Latest Christmas Fad

WRAPPING Christmas gifts in wallpaper is a pleasant way to utilize those old half and quarter rolls of fine wallpaper lying around in simost every attic. It is the latest diversion from the conventional holly paper and the effect closely rivals that obtained by the use

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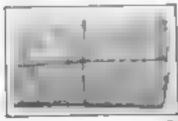




of expensive parchment wrappers for presents, which of late years has been used by those persons who were able to afford it

If your workshop does not contain a few old rolls of wallpaper, the paint or wallpaper store is pretty certain to have some old sample books that are just the right size for ordinary packages. They are usually given free for the asking

The gilt Christmas cord sold in drug stores for a few cents a yard can be repro-



Papers with bold potterns are used for large peckages and finely figured sheets for the prodlet pits

dured cheaply in the home workshop by ordinary DASSINE wrapping twine between the bristies of a brush moistaned with thin varnish. Then dust it



either with gold or silver color bronze powder-you may alternate them every few inches, if you wish. When the cord is dry, you will have a first-class piece of Christmas-package twine.

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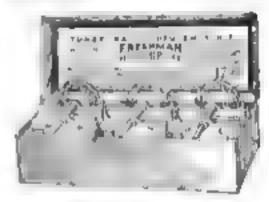
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In Prostate trouble, mental and physical powers are both lessened, Nervousness, resilence or and free more frequency appear, a stea, weak back, a k of vigor and chronic cohe to par are frequent symptomic. There is often pure in the back, botto, feet and less. Often the blood pressure increases to a dangerous degree.

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How to Heat Hot Water with Half the Gas

N A comprehensive examination of thousands of hot-water heating installations made by the writer, it was found that hundreds of tanks were heated by means of a burner placed directly under the bottom of the tank. This, of course, is a gas-wasting method. Nevertheless, this system can be made to operate efficiently if a jacket composed of two

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TO PAUCETS

layers of air-cell corrugated ashestos paper is ap-plied. Do not use plain asbestos pa-

Contrary to the method of jacketing systems employing a coll heater, the asbestos paper must not touch the tank. A separator made by twisting two atrunds of 14-in. asbertos packing rope together, is wrapped securely around the tank as shown. ischeting then is

applied. This leaves an air space of from 35 to 1 in. between the tank and jacket.

The separator guides the extremely hot burnt gases spirally over the entire surface of the tank A gas meter connected with the gas supply feeding the tank burner before and after the jacket instaliation proved that slightly more than half the gas formerly used makes possible me production of all the hot water needed.

The outside cover is made from ordinary sheet iron and need not be covered with asberton. Note that the bottom of the jacket should just kide the burner

The best results are had when the burner flame is non-luminous, that is, when the flame is of a faint reddish blue color and without a trace of yellow or OPENER -- JOHN H. BCHALEK.

Spreading Liquid Glue Quickly over Large Surfaces

SPREADING liquid glue over large surfaces, as for gluing maps or large sheets of paper, it is often difficult to distribute it quickly enough to prevent part of the surface drying before all is

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To close the holes after using, simply stick a small patch of paper over them. -M. W. Lowry, Athena, Ga.



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"Then the Lion Fell Dead"

(Continued from page 39)

lurks in the bush, never attacking until he has to as a last resort. Klein agreed that the lion rarely will attack a man first.

"A lion isn't a coward," he said, "but he plays his own game. Perhaps he is lying in a cool place in a piece of brush and sees you go by. If he thinks you haven't noticed him, he'll watch you and never say 'boo.' But if he thinks he is observed, he'll run off to the nearest shelter. You follow him and he'll run again. He will do this once or twice, then he will come for you,

"USUALLY a Honess will jump out of her ambush as soon as she hears you coming and roar to let you know that she will defy you. But once we were right at the entrance to a den when the lioness leaped at us. There was nothing to do but kill her. We took the three cubs, whose eyes were just open, back to camp with us, and raised them until they were about two feet high,"

Big game is disappearing in Africa. The natives are to blame for this, each Klein, for in spite of the laws prohibiting it, they massacre the animals in great game drives. Klein is the only white man who ever has witnessed and photographed one of these native game raids.

"One evening in the twil ght," he said,
"I went up on a mountain called Benagie
with a native, to look for lions coming
out of their lairs. If I could locate a lion
den in the evening, I would know just
where to hunt the next day. Lions, like
all other game in the jungle, come out only
in the sarly morning and in the evening

"I saw a lot of natives running, and before them were mebras, giraffes, clands and other game. I pointed them out to my servant, who said, 'Oh, master, they're trailing the game. Watch for their camp.'

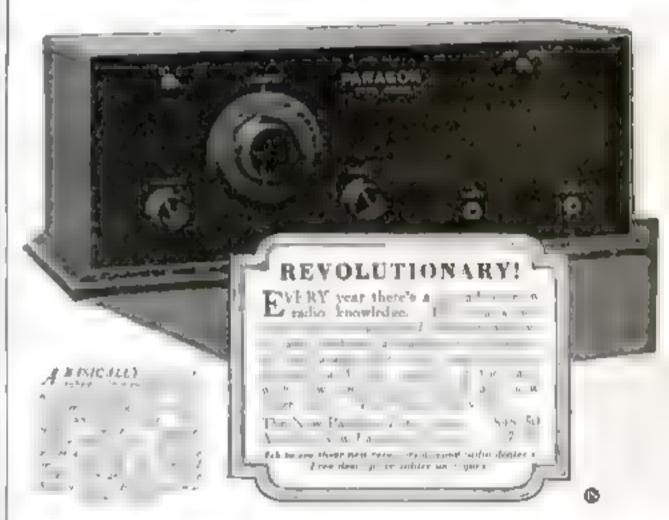
"I located the spot where they seemed to stop, but it was too late then to do anything; the place was too distant. At daybreak next morning, I was in my saddle, and with 15 natives rade to the spot. We caught the natives in the thick of the killing part of the drive. They were akinning the animals, while their wives and children were cutting the meat in stripe and drying it over fires, getting ready to carry it back to their homes, two days' march away.

"THEY grabbed their spears. I convinced them, however, that I was not a government official, and they allowed me to take pictures of them in the pits. They had no fear of the camera. Some tribes have, connecting the camera with the 'Great Evil Eye,' but these natives belonged to an extremely primitive tribe, incapable of forming an association of ideas like that.

"Preparing for a big-game drive, the natives dig 82 rectangular pits about eight feet deep, arranged in the form of a V, with one pit in the first row, three in the second, five in the next, and so on. The dirt taken from the pits is thrown back of the last and widest row, making an

continued on page 158





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"Then the Lion Fell Dead"

Contrassed from page 157)

embankment. The holes are covered with light shrubs, sticks and straw. On each side of the V, extending for a long way, a barrier of heavy thorn bush is erected. Then the natives go out and round up

"They start out in the early morning and arrive at the pits at nightfall, driving the game before them. They close in, so that the beasts have to go between the thorn-bush fences toward the pits. At last the hunted animals are on top of the embankment. The hunters come closer. Then giving one last desperate leap, the animals jump forward and fall in the pits, where their legs are broken and they are crushed one egainst another The natives then rush in with speam and possoned arrows and kill the mangled benita.

"IN THE pits I maw, there were 62 animals, including four giraffes, five elands, a gnu, a hartebeest (a big antelope), a beautiful gazelle, a sebra, and even a rabbit. It was the worst managers of wild animals I ever have seen "

There are dangers lurking everywhere in the jungle, Klein declared. A man may go to sleep peacefully beside his campfice, and the next day his body will be found beside the dying coals, a poisoned arrow through his breast Vengeful savages attack stealthily, and usually no one ever knows who committed the crime. Once Klein had a chance to solve a murder mystery of this sort.

"We were out after lions," he said, "and were camping one night beside a swollen river. On the opposite bank we noticed four natives who were driving eight cattle and some goats. During the night a raiding party of natives came and with poisoned arrows killed three of the men sa they slept. The fourth, a boy, escaped, and climbed a tree

"At daybreak, the boy, hearing the noise of our dogs and chickens across the river, called out to us for help. I got into my cance and shot across the stream. In an instant I may what had happened.

"I FOUND 19 arrows. The natives all have their arrows marked with personal identification signs, so that when several shoot at an animal, the one who makes the hit can neove it is his. I sent a boy with two arrows to the district communioners. They held a court and found the man who had made the weapons. Through them the owners of the arrows were found and, inter, hanged

Courage and patience are the qualities that Klein considers most smential for the big-game hunter, especially for the hunter of lions. To make sure of killing a lion, he says, you must wait until he is within six or seven feet of your face

A lion is tearing at you! Only 10 feet away! Pull the trigger then and you may he a dead man. If you can wait an instant longer, you are safe. That instant ? is the supreme test.

klein could meet it, and that is one reason why today he is able to tell his remarkable story.





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Power for Everybody

(Continued from page 55)

eminent power engineers of the world to get behind the project of tapping the internal heat of the earth as an undertaking "important enough, both scientifically and economically, to justify its being made the subject of an international co-

operative enterprise."

"The cost of such an experiment," said Mr. Rice," would be trivial compared with the value of the possible information that might be gained by the investigation of this unexplored region of the earth. If only the people and their representatives had the faith and vision of science, the value of such an idea would have been put to practical test long ago."

And it is of record that more than 200 internationally famous engineers who heard Mr. Rice and more than 100 who heard Sir Charles Parsons, in each case offered unqualified approval of this

revolutionary idea.

MOREOVER, the United States Government has taken the initiative. among all the nations in the world, of investigating the possibilities of the idea on a large scale. In the grater and on the slopes of Mount Kilaues, the famous Hawalian volcano, a party of government volcanologists recently started drilling to study the changes in temperature that occur toward the center of the earth, to obtain new knowledge of mineral and gas changes beneath the ground, and to determine sciuntifically how the heat of the earth's interior may best be utilized for power purposes.

For some years, too, engineers in Italy have been utilizing the steam from the bolling springs of volcanic regions to

operate engines.

Only recently at Healdsburg, Calif., 75 miles north of San Francisco, engineers drilled 300 feet into the ground to tap a great supply of natural steam lying beneath 4000 acres of volcanic land. Thus project is nearing completion, and the engineers in charge my that the power from their natural steam boiler, when suitably harnessed, will be sufficient to light and heat San Francisco and run every factory in the vicinity!

SO MUCH, then, for the feasibility of a scheme such as Sir Charles Parsons suggests. What, though, does it offer us in the way of practical possibilities?

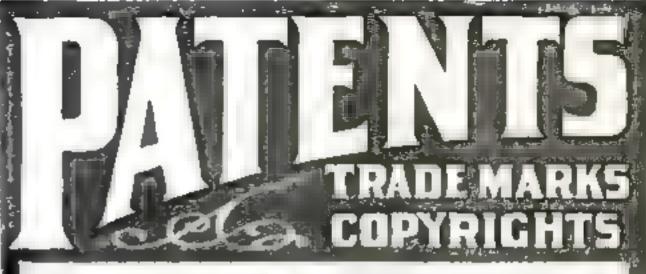
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goes for power

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Even the rawest food represents power, in transportation, in the mechanical sowing or harvest, or in all of these.

(Continued on page 16)



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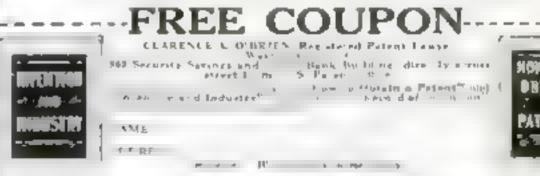
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Power for Everybody

(Continued from page 159)

There is virtually nothing that we can buy, the cost of which does not include the price of steam or electricity

In fact, we may truthfully say that our modern civilization rests entirely on the use of power, most of which is made by steam boilers that use roal. Merely to carry on our daily activities we need about 100,000,000 horsepower, an amount that, without our modern mechanical appliances, could scarcely be furnished by 4,000,000,000 men, or more than twice the present population of the globe. Without coal, in short, our civilization would collapse in a week.

Now, eliminating the possibility, often suggested by scientists, that our two principal sources of power—coal and oil—eventually will be exhausted, the benefits that would accrue to mankind were the power shaft conceived by Sir Charles Parsons to be constructed, ought to be apparent.

TO BEGIN with, such a source of heat, once the initial cost was paid, would supply power at one-tenth to enetwentieth what it costs now to derive power from cost. And that would mean, for example, that we could cut our railway and ocean freight rates in half at least. It would mean that we could heat our houses all winter for what one ton of coal costs now.

from coment, and other building materials could be produced so cheaply that rents could be reduced to a level never before known. Ten-dollar shoes would cost no more than five or six dollars. A \$50 suit could be bought for \$25 or \$30.

A \$1000 automobile according to the present scale of prices would give its manufacturer a generous profit if sold for \$600 or \$700. We could count on the buying power of our dollar being increased to a dollar and seventy-five cents or two dollars. We could irrigate the great deserts—places such as the Sahara and Death Valley—and treble the food supply of the world.

Nor are the possibilities suggested here merely idle speculations. They are based on the estimates of foremost engineers, economists, and agriculturists, arrived at by calculating how much power is imprisoned in the earth's hot interior. Their figures are staggering. Expressed in numerals they convey no clear idea to the mind.

IT is futile, for example, to attempt to appreciate the magnitude of such a number at 200 million million million—the heat of the earth, acientists say expressed in terms of tone of coal. But we do understand when science tells us that this heat is infinitely more than mankind will require to supply all possible needs for power and fuel until the end of time. One shaft, of course, would not make this entire supply available at once. But one shaft would point the way to others and thus the power problem of the world would be solved.

The future of man is in safe hands. Science today is marching as a valiant vanguard, smoothing the way for the coming generations of the earth.

A Garage to Fit Your Car

Continued from page 87)

The floor should be constructed of cinders or broken stone from six to 10 inches deep, covered with from three to four mehes of concrete, consisting of one part Portland cement, three parts sharp bank sand, and five parts clean boiler cinders or crushed stone. The surface of this should be graded to a pitch of two mehes in 10 feet to a floor drain immediately under each car. The surface of the concrete should be dressed, before setting, with Portland cement and sand morter in the proportion of one to two.

A garage of this type may be of almost any kind of construction-shingle, siding, metal lath, with stuceo, hollow tile, concrete block, brick-depending on your inclination, the architecture of your home, and the amount of money you wish to spend. Such a variety is possible that the cost of construction may range between a few hundred dollars and several

thousand.

METAL lath carried all the way up on both sides of the stud frame of the wall and plastered inside and out with Portland cement stucco, with a ceiling of like construction and a fire-resistant roof. will give a semi-fireproof construction that will be passed by most fire or hulding departments and result is lower insurance rates. Fireproof such for door and window construction will further safeguard a building of this type.

Or you may have completely freproof construction -concrete block, hollow tile, concrete, brick, or stone walls, with roof of reinforced concrete, combined reinforced concrete with hollow tile, or ribbed metal lath and concrete, finished with tar and felt, siste, asbestos shingles, ribbed metal, or clay tiles. Such a building takes the lowest insurance rate, and, if near your home or other buildings, is likely to cause reduction of the insurance rates on them.

ARAGES built into dwellings recently have become popular. It is almost needless to say that a garage of this type should be fireproof, or at least semi-fireproof. In many places the former kind of construction is obligatory. The built-in garage, properly safeguarded, probably is the best of all. It is convenient, it can be heated from the house plant, it can be electrically wired easily, and, when constructed at the same time as the house, is the most economical kind of garage to build, especially if the house is on a terrace, has a high basement, or stands on and graded so as to permit you to make

Because such a garage is easy to reach and pleasant to work in, the car that occupies it probably will receive more care than the car housed in a detached garage. This means longer our life and less expense

the garage part of the cellar

for upkeep.

The twin dangers of the built-in garage which, however, may exist in any garage are gasoline fumes that collect along the floor, and carbon monoxide from the exhaust. These may be eliminated by proper vertuation and an automatically Continued on page 162,

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A Garage to Fit Your Car

(Continued from page 161)

closing fireproof door at the house entrance.

In many parts of the United States it is unnecessary to supply a garage with Alcohol, patent compounds, or draining the radiator will prevent freezing. A heating plant in the garage needs frequent attention and is likely to be neglected. All things considered, the best plan is to carry a heating line and return line from the house to the garage through a trench, the depth of which will depend on the climate.

If a beating plant is installed in the garage, it should be in an entirely separate room, with no connecting door and with a floor two feet higher than the garage floor. Any kind of open heater—gas, oil, or coal stove—is dangerous in a garage because of the gasoline fumou that almost constantly are drifting along the floor.

PHERE are many other features of garage construction that space will not permit me to discuss. Buch items as the kind of hardware to be used, for example, will demand careful attention when the time arrives for you to build. Local conditions of various kinds—the cost of materials and labor, fire-department regulations, the type of surrounding buildings-all will have considerable bearing on the sort of garage you build. Your garage is an individual problem, and no one can help you to solve it better than your local architect.

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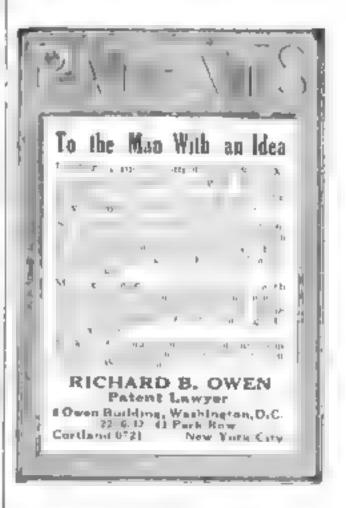
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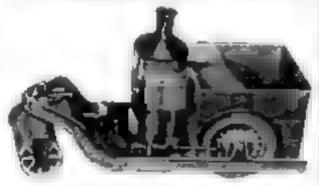
What I Have Learned about Toys and Men

(Continued from page 43)

leaders. Suppose there were 100 men, and the one in command was killed. There was another who could take his place, and it some instances, still a third who could command. But after that there was chaos. Most of the other 9? were trained automatons and nothing more. The whole formation went to pieces.

Now take 100 men in an American company. If the leader was shot, there always was another to replace him, another after him, and another after him, and another after him—volunteem down to the last five men. They had learned to lead so playing children.

The toy educates the child. So says the psychologist from his learned tests,



A new toy mechanical street-coller that so driven by a real minusture street-enquir

and so say I from observation and experience. How does it do so?

First, by giving the child accurate images. It is extremely important that a child get a correct idea of things. The first impression in the brain cells is very likely to be the deepest. The toy should be as nearly an exact imitation of the teal thing as possible. The toy that isn't designed right is a very bad thing. A child is given an angine. If it is an exact imitation, the child will remember it as an accurate angine for the rest of his life. But if it is a poor imitation, he will remember it as a poor engine just as long.

Children, through mechanical toys, are keeping pace with progress and the times, as witness the mechanical Mail Plane and the Yell-O-Taxi. The child, through the medium of play, is unconsciously absorbing knowledge of the important events going on around blm. He may not understand why mail is being delivered by airplane, but he knows it's being done

When you are giving a child a toy, give him something good. If it is a wagon, get him one that will stick together for five years. If it is a tool, get him one made out of good steel. A boy who has learned to love the feel of tools in his little woodshed workshop will keep that love throughout his lifetime, and as he grows older, he will want the best planes, the best hammers, and the best chisels that money can buy, a desire that leads to economy and efficiency. If a child is disgusted with a toy, he will not be disposed to care for the real article that the toy imitates.

One of the best ways to eliminate fear in a child is through toys

You have seen small children who have bung back terrified when confronted by (Continued on page 164,

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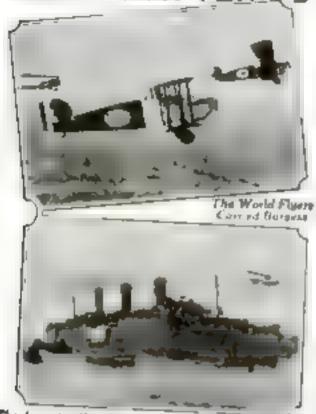
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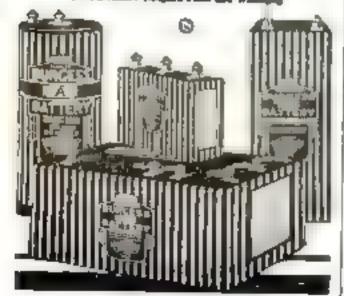
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What I Have Learned about Toys and Men

(Consensed from page 163)

a harmless little dog or cat, or who have screamed when taken to the soo.

As for every-day animals, give the child a toy eat or dog, and it will like the live ones. A child is not afraid of anything it has had as a plaything. Give it toy lious and tigers, and images of other treacherous heasts, too.

The desire to know what a toy is made of and why, teaches a child to think for himself. He takes a little steam engine apart and learns the source of power. He learns the principles of mechanics by watching the pulleys and levers work on his toy elevator.

SENSIBLE toys develop carnestness and that develops leadership. Every great leader is 95 per cent carnest. Can you imagine Pershing trifling? In playing with good toys, trying to understand their mechanism, the child concentrates, another quality needed in leadership.

blany a child in playing with toys has thought up new ideas for toys or improvements for them. Every year I receive hundreds of letters from boys and girls, and grown people too, giving suggestions for playthings. Sometimes they are practical and we embody them in new or old toys. Sometimes they are impractical from a manufacturing standpoint, but the mere fact that the suggestions are made shows that the toys are inspiring children to think. The best ideas for tites have come from boys who have thought of improvements while flying their own.

Every child likes to imitate his parents and adult friends, and toys enable him to do this. Imitation and repetition are excellent ways of impressing anything on the mind.

The first toy that most children receive is a rattle. That must have been in existence in the time of Cain and Abel. It is every baby's heritage. Before a baby is old enough to think, all it needs is something to attract its attention and amuse it.

At two years a girl should have a soft doll and a boy a stuffed house or lion, something for which to feel affection. After this period, when the child is leaving the stage that responds only to impulse and stimuli and when its brain is beginning to develop rapidly, it is time to give it toys that will assist in this development.

BOYS up to 10 or 12 are interested in three classes of toys—friction, mechanical, and electrical. They want to build comething; make comething with their own hands. Girls of this age want something to make, too. They like outfits for sawing, painting, cooking, and modeling. At this age they care more for story-books than their brothers do.

For boys between the ages of 10 and 15 there are many intricate and interesting mechanical and electrical toys. Both boys and girls, in their early teens, like athletic toys—baseball bats, gloves, and masks, sleds, breycles, tennss racquets, croquet sets, movie outfits, and fishing outfits are greated with delight.







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Here Are Correct Answers to Questions on Page 75

- For the same reason that a spinning baseball curves. The way the boomerang is twirled causes a special set of sir-friction forces to be developed and to act on it. These drive it back toward the thrower
- 2. The pituitary gland, a little organ no larger than a pea. It is located on the floor of the skull just below the brain. When it is too active, it produces the seven-or eight-foot grants. When it is not active enough, people are dwarfed.
- 3. Steel is from that contains a very small amount of carbon and other elements. The carbon makes the iron molecules arrange themselves somewhat differently inade the iron. They stick tighter to each other and that makes the steel harder than pure from is.
- 4. Because the skin itself grows as fast as the fat. Notice the folds of loose skin on a once fat person grown thin.
- 5. If you watch them for two or three nights you will see that the planets move a little; the fixed stars do not.
- 6. The axis of the earth, which is the line from pole to pole around which the earth rotates, is tilted a little. As the earth moves around the sun in its yearly orbit, the northern half of the earth is tilted toward the sun for half the year and away from the sun for the other half. When it is tilted toward the sun we have summer When it is tilted the other way, we have winter. The other half of the earth, the southern hemisphere, has its seasons reversed because it is inclined toward the aun when our half is inclined away
- In a crystal the atoms are arranged in a certain regular way, like bricks in a well built wall. A crystal of common salt, for instance, is built up of, first, a codum atom, then a chloring atom; then another eodium atom and another chlorine atom, Ahd so on.
- Radium produces heat and we find that there is a little radium in practically all rocks. How much radium there may be in the rocks deep down in the earth's crust nobody knows. It may be that there is enough of it to keep the rocks hot or even to make them grow hotter
- 9. Though this is a common question, it is a foolish one. You could not have both an Irresistible force and an immovable body
- 10. There are two emential differences First, animals are able to move from place to place, while plants are not. Second. plants are able to make their own food out of sunlight and common chemicals, while animals must depend upon eating other animals or plants.
- 11. Fluorine It is a poissonous, intensely corrosive gas | In its pure form it destroys al, aving matter, yet a very little of it, in chemical combination, is necessary for the enamel on our teeth.
- 12. Yes. If you pump water into one end of a full pipe, water will flow at once out of the other and. Just so with the electrons. The wire is full of electrons in the beginning. They are not moving, each one stays close to its particular stom. Then you pump more electrons into one end of the wire with a dynamo. Electrons immediately flow out of the other end.

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How Typewriting Betrays

(Continued from page 46)

feet,' that is, the letters do not strike perfectly, so that part of each letter will be dark, the rest light. Or the type may be damaged either by design or through rough usage.

"In a will contest not long ago the principals in the case had reason to believe that the meaning of the document had been changed by the addition of a clause to a certain paragraph. The typing of this disputed section was lighter than that of the rest of the will, and the defending lawyer explained this by saying that this part had been typed a day later than the rest, the same typus using a much lighter touch.

"AN EXAMINATION of the will showed it had been typed on a machine the letters of which shadowed themselves slightly, presenting the appearance of double letters. Repeated tests showed that the machine would not shadow under a light touch, but invariably shadowed under a heavier touch, no matter what the condition of the ribbon.

"These tests were sufficient to prove that the same pressure had been used in typing the second half of the paragraph, and that the work had been done long after the first part had been typed, when the ribbon was weaker from continued

"Not long ago two government agents called at my office and placed a mimeographed sheet on my deak.

"'What can you tell us about this?'

they asked.

"The only thing I could tell them at the time was that the stencil had been cut on a typewriter of a certain make. Further examination disclosed what brand of stencil paper had been used. I also searned the name of the manufacturer of the mimeograph paper. Now, in thousands of husiness offices in New York City mimeographing is done every day. There are several hundred concerns also that do commercial mimeographing. To find where this particular sheet had its origin would seem like an almost impossible task.

HOWEVER, the fact that a certain make of typewriter, a certain brand of stencil paper and a certain kind of mimeograph paper were used in preparing the sheet narrowed the search somewhat, and eventually the office where the mimeographing was done was found. The details of the case on which the federal agents were working I bever knew, but through the data revealed by the typing, the identity of the person who reproduced the copy was established.

"Substitution of letters in repairing a typewriter often has been a means of identifying a machine as having done a certain piece of typing. Manufacturers sometimes change the form of one or two letters when they put out new models. The r on a well-known typewriter was changed recently, and the manufacturer informed me of the change. That knowledge may help me solve a case some day.

"Knowledge of the change of a cent mark (s) on a certain type of machine (Continued on page 167)







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4. 0. 1408488, Sain M., 76 in Ana., for loss

How Typewriting Betrays

Continued from page 166)

once pointed to the spuriousness of a document. In this case I was able to identify the machine on which the disputed document was typed as one that carries its type on a circular shuttle that turns and against which the paper is impressed at each stroke. Certain mistakes in the typing could not have been made on any other typewriter

"Some typewriter manufacturers make their own type, others have it made by type founders, and when a type founder rupplies the same or almost the same kind. of type for two different kinds of typewriters, complications are almost certain to result if one attempts to identify a specimen of work done by either machine.

AN INSTANCE of this occurred in the langest case I ever hundled, one that required months of work and a nationwide search for a single typewriter. The principal was a woman who was suing for a share of a large estate on the ground that she had been the common-law wife of the dead man. To prove her contention she offered a typewritten letter, which she said had been signed by the man. Typing and signature were believed to be false.

"When I examined the letter I believed it had been written on a certain typewriter. When I went to the factory to aubstantists my opinion, I found that machines made by this company at the time the disputed letter was dated, were likely to have type made by the company itself or by either of two type makers. I found also that one of the type makers also made the type for a portable typewriter, and that the deceased had owned one of these.

"I knew that the woman and the man had lived in many places throughout the entire country. A thorough search was made of their former haunts for typewriting and machines, but with no results. Through it all, however, a strong 'hunch' persisted in telling me that the disputed work had really been done somewhere in New York City. With the aid of detectives I found at last a place with more than a hundred typewriters to which the woman in question at one time bad

"I KNEW the machine I was looking for had to have 10 letters to the inch. So I had detectives get me secret samples of the work of every typewriter in this place. I quickly weeded down the samples to include only 10-point writing Thus a country-wide search was narrowing down to a score of machines.

"On these specimens I looked particularly for some of the 18 minute characteristics I had found in the type impressions on the disputed document. I knew, for instance, that the desired machine would have certain small imperfections in the ! and a. As I went through the final batch of samples, seeking first one telltale defect, then another, I finally found a sample that coincided perfectly in many particulars. This was irrefutable proof that the culprit machine had been discovered? "I requisitioned this, and additional

(Continued on page 101),



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WHENEVER you hear of anyone having trouble with a circuit, nine times in ten it is because of the parts.

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Take the grid leak for instance. It is the heart valve of your set. Unless it provides a perfectly smooth electric path for the current to escape from the grid of your detector, miniature thunder storms crackle and rumble within the tube, emothering weak eignals, distorting and muffling strong ones.

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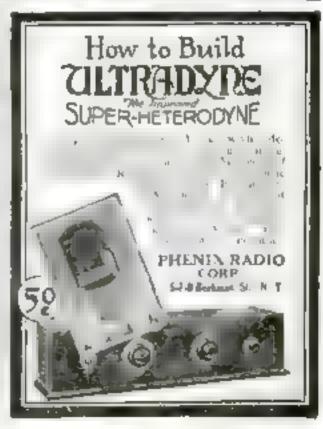
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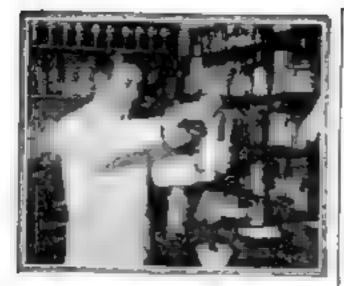
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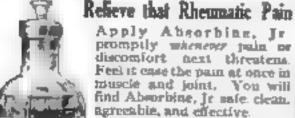
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for giring

How Typewriting Betrays

(Continued from page 167)

samples taken from it strengthened its guilt. Not only that, but before the muchine was obtained, the questioned writing had shown me that it had been made by type turned out by the makers of the typewriter instead of either of their outside type makers. The machine steels verified the fact that it was not in existence at date of the letter, thus proving the date of the alleged letter to be false as well am the letter itself "

ALTERATIONS and erasures, Mr. Horton told me, whether in typewriting or in longhand, frequently are revealed by chemical tests. Though the original writing may have been obliterated so successfully that the eye sees no trace of the change, it frequently happens that traces of the ink or typewriter ribbon will remain on the paper. In such a case, treatment with certain chemicals will cause the erased writing to appear once again, faintly perhaps, yet clearly enough to be discerned and recorded by the microscopic camera. This method is of especial value in detecting raised checks or those on which the name of the payee has been altered.

Knowledge of the purely mechanical characteristics of various makes of typewriters likewise is an essential part of the equipment of a questioned-document expert,

Any expert typus will tell you that it is impossible to insert a sheet in the identical position it held before in case it is necessary to make an alteration in a piece of typing. And so when an alteration of this nature is made with criminal intent, even though the same typewriter he used with a ribbon in the same condition, the substitution usually will be apparent to the expert through exceedingly minute differences in spacing and alinement between the original document and the altered part.

Detection of small differences in spacing, Mr. Horton told me, once enabled him to save the heirs of a wealthy man a large sum of money, an innocent paper which the decreased had signed having been changed into a "note" by a clever

Thus science as exemplified by the questioned-document expert protects sodety against the depredations of the criminal, safeguarding the good name and property of both the living and the dead by hampering the thief, the forger, the blackmailer, the writer of anonymous letters -all who by pen or typewriter seek to prey on their fellow men.

PIFTY-FIVE mail carriers have lost their lives in the performance of their duty in the last 30 months. Behind this unembellished recent announcement of the Post Office Department lies a tale of the loyalty of strong men who risk death to deliver the letters you mail—a dramatic story of heroism to be told in next month's issue of POPILAR SCIENCE MONTHLY

You won't want to miss this thrilling account of how men of the postal byways battle their way through unsettled RADIO SETS — AUTO BODIES SEMP FOR THE INTERNATIONAL CATALOG



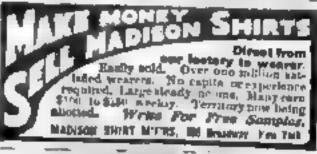
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They Did the Impossible

(Continued from page 50)

duction scheme, though it showed we were on the right track. Finally, we tried blowing the hole through with a current of heated air, and the problem was solved theoretically.

"There remained, however, the question of practical and economical production. Our engineer accomplished this by constructing special machines that automatically do the work we did by hand.

"These machines are a marvel of precision, performing delicate work more accurately and quickly than it can be done

by hand."

I T WAS then my privilege to witness one of the marvels of modern engineering-steel fingers shaping brittle glass into perfectly sealed vacuum bulbs.

One machine made the standards, the little glass tubes that hold up the giass filament posts. An automatic feeder fed the standards into a horizontal circular machine about four feet in diameter. Sticking out all around the circle were many little pairs of tongs. Each pair, with almost human precision, grasped a tube standard from the feeder.

The circle rotated in steps. First the standard received a scaling tube, which was automatically welded in as the circle slowly rotated, bringing the standard into successive contact with little gas flames. Then air was blown into the sealing tube, bursting a tiny hole through the

aimost molten giam.

Next, the standards, ready for the filement, were carried in boxes to another machine. Here a girl wound on the filement, connected and set the standard in a machine, filament upright. The sealing tube connected with a pipe, which at the proper time was connected with an exhaust pump. Then the glass bulb was placed over the standard, and the machine did the rest -welded the bulb to the standard, exhausted the air, and sensed off the little sealing tube. Finally the brame buse caps were cemented on.

It was not a method of eliminating the

tip—the lamp never had one!

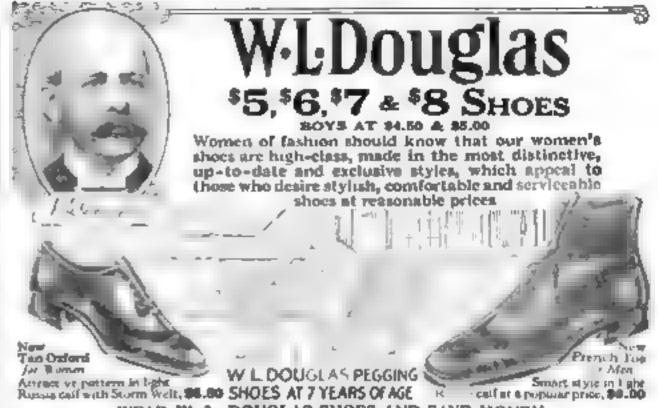
And what are the advantages of the tipless lamps? In the first place, they are cheaper to you and me. Lem breakage and the fact that the job is practically automatic, requiring much less skilled labor, is the reason. It is surprising how hard it is to brenk the new lamps. In the little experimental factory, they are carted around in Iron bins just like bolts.

A NOTHER advantage is the fact that 📤 📤 the lamps can't be refilled without detection. Finally, it is possible to place the filament exactly where it is wanted inside the bulb, a great advantage in the case of miniature lamps for autos where the slightest variation in placing the filement will throw them out of focus.

So it was that a problem that puzzled the acientists was solved by practical men who kept hunting until they found the

Way

By the time this is printed, tipless vacuum tubes for radio will be on the market, and the price of them will be down, according to the two young inventors,



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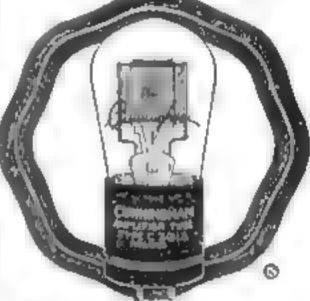
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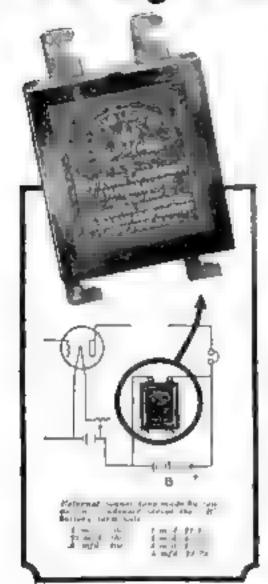
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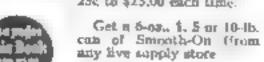
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A Superior Battery Solid Rubber Cam Sing honory does 2.1.4 kg. p. 1.5a is how to indicate and property of food providence. It is not home particle para above require above on the providence of the providence of

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SAVE \$2.00 BY ORDERING NOW!

How to Wash Your Hands

(Continued from page 5.2)

little mutten tallow into the skin when dressing, then cover with tissue paper and draw up the socks or stockings over the

Many people who otherwise would be in constant misery can go through the winter very comfortably in this way.

MAN of 52 years, in business, came A to me one January complaining of stching of his legs from the middle of his thighs down to his feet, and occasionally of the arms and forearms. He told me that the itching always was worse when the skin was exposed to cold, or when he undressed, or when the skin was rubbed. Moderate restriction of his bathing and the use of a thin salve containing lanoline gave him complete relief.

Frostbite is a real freezing of the skin, and fortunately is not common except, perhaps, in the most northern parts of the country. The bodily extremities are most apt to suffer—the ears, toss, and fingers, and then the nose and checks. The first sign of trouble is often the loss of feeling. The care do not feel as cold as they did, not because they feel warm, but because they have no sensation at all The skin becomes white instead of red, and feels harder to the touch. If the trouble is discovered soon, it can be cured without ill effects, although a part once frontbitten is usually sensitive to cold for years afterward.

If the freezing is allowed to continue, recovery may be impossible, and the affected skin, when it thaws, will become gangrenous and drop off. The treatment in such a case is of the greatest importance. The thing to remember is that the thaving out must be gradual. A rapid thawing, such as by wrapping the part in bot cloths or placing it in hot water, often will result in gangrene.

THE old method of rubbing the frozen member first with snow is as good as it ever was. Gradually, as the flesh thaws out, the color will return and the circulation will be re-established. If snow is not available, rub with cold water, and do it all in the open air, not in a warm

No directions for the care of the skin, in winter or summer, would be complete without reference to your general health, for the skin is often a good index of a man's condition. Follow a varied diet. being particularly careful to include green vegetables and milk, which provide vitamines as well as nourishment; but avoid any excess, especially of sweets and meat. Ordinarily, in the United States, more harm is done by overeating than by undereating.

Take eight hours' sleep every night, always rest half an hour before the hearty meal of the day. Last, and the most difficult to follow, take at least an hour's exercise in the open air every day. In other words, put yourself, and keep yourself, in the best possible physical condition, and you will be relieved of many of the annoyances that in their sum total make the difference between comfort and misery, between spontaneous cheerfulness and continue! il. humor.

NO-HTOOME

REPAIR

#00K

How I Play Radio Doctor

(Continued from page 79)

voltage is lower than these values, you must get new B batteries. Discard only those that are low, in case you have two or three B batteries.

To test the telephone plug, touch the point of the plug to one terminal of a 22volt battery and connect the wire from the barrel of the plug with the other battery connection. This should give a strong click. If it does not, take of the plug and touch the telephone cord tipe to the battery terminals. If you bear no sound or only a very weak sound, the telephone cord is broken inside the insulation or the magnets have lost their magnotism. Take the telephones back to the dealer, but do not open them to examine the inside. You may accidentally break one of the tiny wires.

Some types of loudspeakers and telephone receivers must be connected in a certain way. If the tips are reversed when they are connected with the plug, the signale will be weaker and, in a short time, the purmanent magnets may lose their magnetism. You can experiment by connecting the tips one way and then the other to see if there is any difference in the signal strongth. Leave them in the posttion that gives the loudest signals.

When you buy a radio set, ask the dealer whether the positive lead from the phones should be connected with the point or the barrel of the plug. Most phones have a terminal on the receiver cap marked +. If this is the case with the new set, he sure that lead goes to the part of the plug that the dealer says should take the positive tip.

You may find that all these tests do not bring out the source of trouble. If they no not, the trouble may be in the tubes, for at times the tubes will light even though they are defective. It is always well to buy tubes from a dealer who has one of the standard tube-testing instruments. Then you can be sure that your tubes will be right when you buy them Dealers handling standard makes always will replace defective tubes if the filements have not been burned out

"HERE are two other things that must be considered. The first is the storagebattery charger. Once you have become acquainted with this device you should have no further trouble with it, but it may puzzle you the first time. He sure to connect the positive lead from the charger to the positive terminal on the storage battery. Some people think that, since pontive usually goes to negative, the 4 terminal of the charger should go to the connection on the battery. As a matter of fact, in this case positive goes to positive.

Successful buttery substitutes now are being put on the market and every one is thinking about using them instead of batteries. Unless you get a device that will replace A, B, and C batteries, you will not save money, although, to be sure. it is much musier to hook on to the light socket and do away with the necessity of bringing home B batteries. When you buy a substitute device, get it from a dealer who can install it for you. Once it is put in, you will have no trouble using it.

To everyone on the list-give Evereach flashlights!



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Benning I hit City He and mis as all makes of flashinghis, They in are to chie I and that langue but tony it is



GAIN the Christmas season! A Suggestions and counter-suggestions . . . "Give this" . . . "Give that." Here's the happy solution: Give flashlights, Everybody wants an Eveready.

Because it is a gift that is goodlooking as well as practical and safe: because it appeals alike to young and old; because it does so much and costs so little.

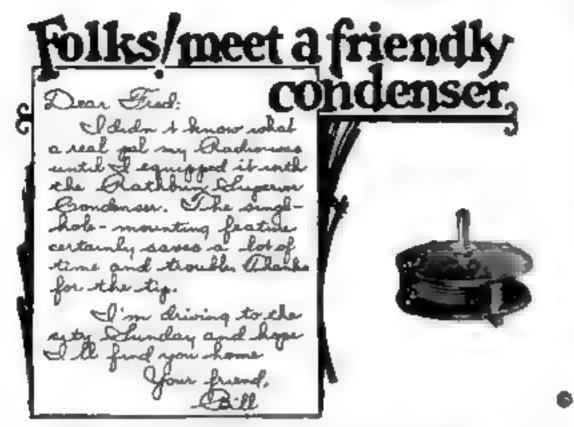
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You fellows who don't claim to know all about condensers, may learn something worth while about a friendly condenser. You, too, may not know what a real pal your Radio set is until you equip it with a Rathbun single-hole-mounting Superior Condenser

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Confessions of a Radio Gyp

(Continued from page 78)

we got full price for tubes, but when the national manufacturers caught up with the market, we had to cut prices on the bootleg variety to meet the competition. Now all makes of tubes are gypped at cut prices.

HE jobbers help the gyps to do that, A jobber often will sell a large order of tubes at a small margin of profit for cash. There usually isn't much profit for the gyp in selling genuine tubes at cut prices on thus basis, but the cut rates on tubes generally will entice the customer into the store, after which the gyp will use his wiles to unload a quantity of other goods on him. Often you will find, if you try to buy the tubes that are advertised at cut rates, that there's a string on the offer. Before you can buy a tube, you must buy other merchandise—usually stuff that you don't want and that is no good.

Formerly we used tubes to help us sell sets. All the sets on display in our showcases contained good tubes, so, of course, if the customer wanted a demonstration, the set worked. But if the customer bought the set, while it was being wrapped up, one of our helpers would allp in a set of bootleg tubes. If the purchaser came back, we told him that the location of his home must be bad for radio reception, and pointed out to him how well the set had worked in the store

Most of the time he'd believe us, because it had become pretty well known that certain places were "dead spots" for radio. When he was convinced that the fault lay in the location of his home, it was comparatively easy to sell him a lot of additional parts that he didn't need and that wouldn't help his set any.

SPEAKING of radio sets, they're the big sellers now. The public isn't buying so many parts as it used to. But many a patented set has been sold over a gyp counter that never saw the factory of the company whose name and serial number it carried. Many ex-tube bontleggers now are bootlegging the more popular sets.

You may have wondered how we can offer some sets at the prices we do. Sometimes this has been done just to get even with a manufacturer who wouldn't set! us his products. We'd go out and buy the nets that the manufacturer wouldn't sellus at the retail stores, and advertise them at unbelievably low rates. We'd fit them with poor tubes, book up the batteries wrong, and then, when the customer came in for a demonstration, we'd show him the set and tell him it was no good. That way of getting even with a manufacturer was very popular for awhileuntil one gyp was arrested and convicted for unfair practices.

One thing that has burt the gyp stores is the number of broadcasting stations installed in the big cities. Receivers made by gyp manufacturers are never very strong on selectivity, and, if two or three local stations happened to be on the air at once while the customer was getting a

(Continued on page 173)

Confessions of a Radio Gyp

(Continued from page 172)

demonstration, it would be impossible to sell him the set. Then along came somebody with the wave-trap idea. It didn't take us long to see that wave-traps were what we needed to sell our bad receivers. So, when giving a demonstration, we'd hook a wave-trap up in the aerial where the sustamer couldn't see it, and let a clerk operate it while another clerk was demonstrating the set.

Then, of course, if the customer came back to complain that his set wouldn't work as well at his home an it did in the stors, we'd blame it on his location—and sell him a wave trap. Some of these wave traps worked, others didn't; for we'd made them out of eardboard couplers and gyp condensers. A good wave-trap was an efficient device, but the imptations that the gyps put out destroyed public confidence in it, and now you seldom see one.

LOUDSPEAKERS, too, have been very profitable to the gyps. It's easy to take the reproducing unit from a good horn and substitute a chesp one. Then the price of the horn can be cut with profit. After that the good unit can be used as a phonograph attachment and sold at a good price.

Even batteries have been gypped sucresalully. The gyp manufacturer finds It easy to make B batteries cheap sawdust and some sort of chemical mixture in cheap cans. They run for a couple of weeks and then die. That's always been good business for the gyps, because of the repeater trade from customers who don't know any better,

I remember a cheap grid leak that a gyp manufacturer put out. One day a fellow from a testing laboratory came into our place and bought one. He didn't tell me what he wanted it for until he was on his way out, or I'd naver have sold it to him.

A long time afterward I happened to meet this man on the street

"How about that grid leak you were going to test?" I saked.

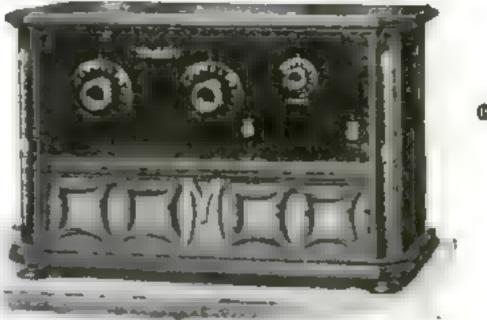
He didn't remember me at first, but when I told him who I was, he laughed

"Why, that leak wasn't any good at ali," he said, "but its mount was of such poor moterial that it made a good leak in itself "

THINK of that, will you! I never could understand why we sold so many of those leaks.

But as I said before, the gyppinh business isn't what it used to be. The people won't bother chasing cut prices while they can buy the best sets, manufacturer's guarantee, and everything, on time. This doesn't mean that the game bus played out altogether. There a still plenty of gypping going on, and the man who doesn't know much about radio had better watch his step when he buys. The public's best protection lies in buying only articles made by manufacturers whose names and trade marks are well known, and then only when the article is in a sealed container with the seal unbroken.





This Beautiful Marshall 4Tube O Non-Oscillating Receiver Complete with all accessories

TRITE TODAY for full particulars of this most exceptional offer. Marshall Sets embody the very latest improvements known to radio. The wonderful new principle involved is proving the sensation of the 1924-25 radio season. Zero Coupling-the problem which radio engineers have been working on for years - has at last been solved. As a result, the Marshall has no need for neutralizing condensers or other make-shift methods of avoiding internal oscil-Inuona which invariably reduce efficiency. The Marshall Tuned Radio Frequency Receiver brings to radio a new degree of musical quality. Its selectivity will delight the experienced radio operator. Yet it is so easy to tune that the novice will handle it like an expert.

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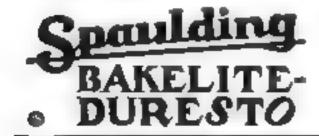
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A-B-C's of Radio Language

(Continued from page 80)

this transfer of electrical energy is something like the transfer of heat from a piece of red-bot iron to another piece of metal that is near it. Also, there is a re-transfer of the induced energy from the second coil back to the first, and from the first coil in turn back to the second, quite as two electric fans facing each other might blow bits of a handful of confetti back and forth between them. This bandying of electrical energy back and forth is called mutual inductions. A coil also has the odd property of induction.

Years ago an electrical experimenter discovered that the mutual inductance between two cods varies in accordance with the distance between them and the angles at which they are piaced with reference to each other. This principle was utilized in designing the device we are examining. The amount of mutual inductance hetween two cods is called the coupling. Hence, various pler is a vivid and understandable name for a device that permits mutual inductance to be varied at will by rotating one coll about its axis within the other.

A somewhat similar device found in some sets is called a seriometer. Thus also is used to vary inductance and consists of two coils, one of which turns inside the other, but, instead of being separate, as in the variocoupler, the two coils are connected in series.

LIKEWISE variable inductances are produced in crystal sets by mounting two parallel coils one inside the otherso that the outer coil may be moved back and forth over the inner, or by providing a single coil with one or two slides that have the effect of increasing or reducing the number of turns of wire that compose the coil by making contacts at various points.

indeed, a method very similar to this last is employed in the set we are inspecting. The primary coil of the variocoupler has been topped at various points, each an equal number of turns from the next. Wires from these tops are connected with the points to which you may move the switch you see on the front of the panel by turning the knob marked "Primary Inductance." Each time you move the switch from one point to another, the effect is to increase or decrease the size of your primary coil.

Thus, in addition to varying the mutual inductance between the two cods that make up the variocoupler, you also are able to vary the inductance of the primary coll, giving you a greatly increased variation in tuning.

Now, to complete the operation of tuning, there is another factor is addition to varying the inductance of your set to accommodate it to the frequency or wave length of the radio waves you desire to admit. You must vary another electrical property, known as capacity. This you accomplish in the particular set we are considering by turning the dial lettered "Antenna Condenser."

The entenne, of course, is the serial. Each serial has what is called a natural

period of ribration, or makeral frequency, just as each string of a musical instrument has its natural tone unless otherwise tuned. Thus makes the serial sensitive to radio waves of a certain frequency, just as the string of a musical instrument will vibrate in sympathy when the note to which it is tuned is sounded on another instrument near by. And, as with a musical string, you make your serial sensitive to other frequencies by changing its length—not actually, but by adding or taking away capacity by means of the condenser.

A condenser is a device that will store up electrical charges. It is not to be confused with a storage battery, for the latter stores up quite a different kind of electricity and in a different way. Two or more conductors of electricity, separated from one another by a non-conductor, form a condenser. Thus, two sheets of tinfoll placed on opposite sides of a sheet of glass will be a condenser and will store up electricity that is admitted to the tipfoil until the accumulated charge becomes too great. Then the charge ducharges by leaping from one sheet of tin-foil to the other. The conductors in a condenser are known as the places, the nonconductor, the dielectric.

In THE condenser in our set the air is the dislectric. The plates are the parallel metal sheets, one set of which slips between the plates of the other set when you turn the condenser disl, somewhat as you might entwine your fingers. The two sets of plates, however, unlike your ingers, do not touch; they must always remain separated by the air dielectric if the device is to function as a condenser.

This sort of device is called a corrable condenser for the obvious reason that it permits you to vary its especity by turning the knob, the capacity being greatest when the plates are closed and becoming less as the two sets are separated. In some condensors of this type there is a single auditional plate, operated by a separate knob, which may be adjusted after the setting of the condenser has been made. The trifling variation is capacity possible through the use of this device permits of finer turing Such a device is called a remier.

As explained in previous articles, the radio waves that reach your antenna are alternating current waves of high frequency. Any electric circuit offers opposition to alternating current, this opposition being called impedance

In the set we are considering, or in any other set for that matter, you admit waves of a particular frequency by adjusting your inductance and capacity so that the impedance is low with regard to that frequency and high with regard to all other frequencies. That is the purpose of the three knobs at the left-hand side of the panel and the devices within the set with which they are connected

In sets of very recent design the trend has been toward supplying them with fixed inductances—that is, unadjustable coils—and tuning entirely by varying the capacity by means of condensers.

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Property and Complete Instructions

************* Complete parts for 2-TUBE HARKNESS SET

7 x 14" Drilled Bahelite Panel 2 Harkness Reflex

Transformers with Condennets Dials

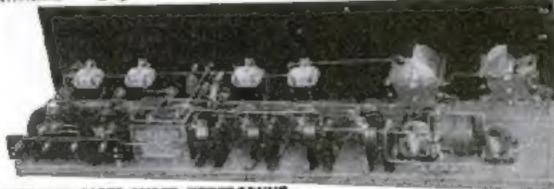
Bakelite Sockets American Bell Transformers 1 Single Circuit Jack 1 R.W Crystal Detec-

1 Rakelite Rheostat 6-

Binding Posts 7 Baseboard and Butbut Wire Blue-print to complete

white

Acme L Tube Reflex Set ... \$17.45 Tube Reflex act ... \$39.85



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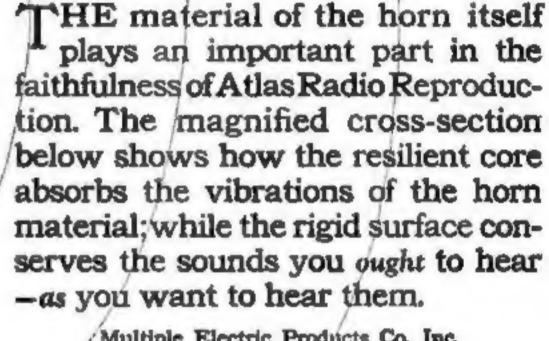
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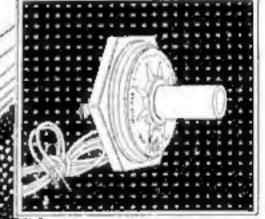
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